RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

WITH WHICH IS INCORPORATED

ROADMASTER AND FOREMAN

BRIDGES--BUILDINGS--CONTRACTING--SIGNALING--TRACK

Published by BRUCE V. CRANDALL

Office of Publication: Manhattan Building, Chicago

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W. A. D. Short, C. E., Editor

A Monthly Railway Journal

Devoted to the interests of railway engineering, maintenance of way, signaling, bridges and buildings.

Communications on any topic suitable to our columns are solicited.

Subscription price, $1.00 a year; to foreign countries, $1.50, free of postage. Single copies, 15 cents. Advertising rates given on application to the office, by mail or in person.

In remitting, make all checks payable to Bruce V. Crandall.

Papers should reach subscribers by the twentieth of the month at the latest. Kindly notify us at once of any delay or failure to receive any issue and another copy will be very gladly sent.

Entered as Second-Class matter April 13, 1905, at the Post Office at Chicago, Illinois, Under the Act of Congress of March 3, 1879.

New Series Vol. 11 Old Series Vol 30 Chicago, March, 1915 No. 3

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The Engineering Association

The sixteenth annual convention of the American Railway Engineering Association takes place in Chicago on the 16th. The advance copies of the committee reports to be presented at this convention show that details and specifications of railway engineering questions have been gone into more scientifically and technically than ever. It is impossible to compute the value of this association to the railway engineering world. But suffice it to say that in the comparatively short time it has been in existence it has been invaluable in working towards bringing system out of chaos. But the work of the association will certainly be on the increase as new and vexatious problems are presented. This will be and has been most ably taken care of by the various committees. It seems to us that the most important work the association has at present is the standardization of the work to be done with regard to the physical valuation of the railways and the recommendations of specifications for standard track scales. When the track scales specifications are established it seems to us that this committee should then assimilate with the United States Bureau of Standards and agree on final specifications. As we have stated before, the track scale is a unit of measure in which the public, the merchant, the business man are all interested, as well as the railway company. Hence the standard or specifications should be a United States Government standard. The establishment of this standard by the Government would at once eliminate the existing friction between the railways and scale manufacturers and between Federal and State Commissions as to scale tests and specifications.

Full Crew Law

Unique among railway annals is the method that has been pursued in Pennsylvania and New Jersey by the railways. The railways have asked the people of New Jersey and Pennsylvania to support them in getting repeal of laws which do not accomplish their avowed purpose. In doing this, the railways also propose that the public service commissions be given additional power, such as will make impossible the undermanning of any train, either freight or passenger. This direct appeal to the public to estimate at their true worth radical and unjustifiable laws, in the process of formation, is a new adaptation of the present growing publicity campaign of the railways. Some of our contemporaries have spoken of the Full Crew law, which is being so vigorously combated by the railways, as the "Extra Crew" law. This is a misnomer as applied in this instance and President Rea has given the proposed legislation its correct caption (see another page of this issue) by designating it the "Excess-man" crew law. In proper railway parlance "extra crew" means one of two things, either a crew which is operating a train that is not regularly scheduled, or a crew held in reserve for the purpose of relieving at once one of the regular crews that have been assigned to regular runs. Therefore the application of the wording "Extra crew"

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to the proposed "Full crew" law is both incorrect and misleading.

The Interstate Commerce Commission

We have called attention to the fact several times that the Interstate Commerce Commission as at present constituted is inadequate both as to numbers and to personnel for handling the ever increasing railway problems of regulation that the Commission is assuming. Inasmuch as government regulation of railways is here to stay and the probabilities are that the powers of the Commission will be increased rather than the reverse, we again emphatically state that Congress should see that the number of the Commission is increased and practical railway men are added to the personnel. President Rea of the Pennsylvania strongly and ably advocates this policy in the annual report of the railway company to the stockholders. This has been called "epoch making," and justly so, as it is the first time a railway president has recommended the regulation of the railways by Commission or otherwise.

"EXCESS-MAN" CREW LAWS

The railroads are still burdened with the needless expenditure required to comply with the so-called Full Crew laws, which are actually "Excess" Crew laws. The principal requirements of these laws, which vary somewhat in the different states, are in substance that every freight train of more than thirty cars must have a second brakeman in addition to the regular crew of engineman, fireman, conductor, one regular brakeman and a flagman; every passenger train having four or more coaches—this term covering Pullman and dining cars as well—and one baggage car, must have an extra brakeman in addition to the regular full crew consisting of engineman, fireman, conductor, baggageman and brakeman, this not to include train porters and Pullman employes; every train composed of four or more passenger, mail, or express cars, empty or loaded, must have a crew of engineman, fireman, conductor, and two brakemen, even though no passengers are carried.

It is estimated that this law has added over $1,000,000 per annum to the operating expenses of the Pennsylvania System East and West of Pittsburgh, and this enforced expenditure is a pure economic waste, because it does not increase the safety or efficiency of operations. This amount could have been spent to far greater advantage in the improvement of roadway and equipment, and in giving increased employment, from which the public and employes would have received real benefits. Arbitrary laws requiring additional men on trains without regard to the necessity for their services, impose a direct and unnecessary burden on the public and the company. Such laws tend to weaken the working discipline, and from the standpoint of the employes not only impair the ability of the company to continue to pay the present rates of wages to that great body of employes whose activities are needed, but also to delay promotion.

CHANGE IN PUBLIC SENTIMENT

The people are now beginning to see that not only has their business for years been damaged by railroad depression, but that facilities for quick transportation are being limited and that equipment is running down to the inconvenience and danger of the public.

That this sentiment is beginning to prevail is shown by such expressions as the Open Letter which came out of the West and which we published last week. This was written by some Western manufacturers. In quoting it from *The Bache Review* recently the *New York Sun* called it "the human side of railroad rate making."

These manufacturers, seven of them, were wrecked in traveling on the Wabash from St. Louis to Des Moines, Iowa. One of their party was killed and others were seriously injured. They state that the wreck was caused by the poor condition of the track and equipment and give it as their earnest opinion that "this is directly attributable to the fact that the road has not been permitted to charge rates such as to enable it to put its properties into condition so that the public's safety and convenience can be properly conserved," reciting that the officials of the Wabash cannot be accused of diverting earnings from legitimate purposes because the road is in the hands of receivers, is not meeting any of its interest charges, but that all its earnings are going to operating expenses and betterments.

They also recite that within the past few months the United States judge having charge of the operation of the road, publicly announced "that the rates were so inadequate that the road could not be properly operated and sufficient funds left to keep its road and equipment in proper condition."

The letter is addressed to the Chairman of the Interstate Commerce Commission at Washington. The signers hold the Commissioners positively responsible for the bad condition of the Wabash and all other railroad properties, claiming that their power is absolute, that they are trying to conserve the people's money at the expense of lives and limbs and that unless relief is quickly afforded, the death roll from accidents, resulting from the poor condition of tracks and rolling stock, will shortly prove appalling. The letter ends as follows:

"There is no question in the minds of the public, but that if the railroads were allowed to charge sufficiently for their services, they would use the money thus acquired in putting their railroads and rolling stock in condition so the public could be served with safety and dispatch, and if death and destruction is to result from your policy, the public, as soon as they become alive to the situation, will hold your commission responsible, and we trust in the interest of humanity that you will promptly take such action as will relieve the situation."

The better sentiment with regard to justice to railroads should affect legislators to an extent that Full Crew laws be abolished and passengers' fares increased in the different states.—*The Bache Review.*

RAILWAY SIGNAL ASSOCIATION

The Railway Signal Association will hold its March meeting on the 15th instant at the Auditorium Hotel in Chicago.

Sixteenth Annual Convention

The sixteenth annual convention of the American Railway Engineering Association will be held at the Congress Hotel, Chicago, March 16 to 18, 1915.

The meetings will be held in the Florentine Room of the Congress Hotel, beginning at 9:30 a. m. and 2:00 p. m. each day.

PROGRAM

TUESDAY, MARCH 16.

Address of the President.
Report of the Secretary.
Report of the Treasurer.
Reports of Standing and Special Committees.

WEDNESDAY, MARCH 17.

Reports of Standing and Special Committees.
Announcement of Result of Ballot for Officers for 1915.

ANNUAL DINNER

The Annual Dinner will be given in the Gold Room of the Congress Hotel at 7 p. m.

THURSDAY, MARCH 18

Reports of Standing and Special Committees.
Installation of Officers.
Adjournment.

FRIDAY, MARCH 19.

Visit to Exhibit of the National Railway Appliances Association in the Coliseum and Armory.

Members are privileged to invite friends to the meetings of the Association, and it is suggested that these invitations be extended by members direct, either verbally or by letter.

Members are requested to register on arrival in Room 1166 of the Congress Hotel and receive a badge, program and other convention literature.

Members are also requested to bring the Bulletin containing Committee reports to the convention, as the supply of extra copies is limited. Additional copies of Bulletins containing Committee reports may be procured by members, at cost, during the convention in Room 1166.

It is the desire of the Board of Direction to make the sixteenth annual convention a noteworthy one in every respect, and it is hoped that each member of the Association will make a special effort to be present and take part in the discussions. Members are urged to give careful consideration to the reports submitted by the several committees, and be prepared to discuss them concisely and to the point.

I. C. C. VALUATION NOTIFICATION

The following railway companies have received notice from the Interstate Commerce Commission that they will be valued as of dates indicated:—

Ann Arbor Railroad, as of.....June 30, 1915
Santa Fe (Grand Canyon Line in Arizona), during winter 1914-1915
Georgia, Southern & Florida, as of.....June 30,1915
Maine Central, as of.....June 30, 1916
Nashville, Chattanooga & St. Louis, as of....July 1, 1916
New York, New Haven & Hartford.....June 30, 1915
Pennsylvania Railroad System:—
Lines south of Philadelphia.....June 30, 1915
Lines in State of New Jersey.....June 30, 1916
Northern Central Ry. and subsidiaries...June 30, 1916
St. Louis Southwestern, as of.....June 30, 1915
Savannah & Northwestern Ry., as of.....June 30, 1915
Southern Railway, as of.....June 30, 1916

The Director of Valuation has let it be known that much better progress could be made by the bridge parties, telegraph, telephone, and other parties if the carriers will —where safety permits—provide motor car service for which the government is willing to pay a reasonable compensation. It is not expected that such service will be required where frequency of train service will make it dangerous.

A meeting has been set for March 22 between the Interstate Commerce Commission and the Presidents' Conference Committee, where subjects of great importance relative to the conduct of valuation will be discussed.

It is rumored that the Commission will ask the carriers to make cross sections of their permanent way with their own engineering forces. These estimates to be accepted as final by the Commission. It is evident that the Commission is at last realizing fully that they have undertaken a bigger job than they at first anticipated and are glad to relieve themselves and the Government of the responsibility and expense of doing the irksome cross-section work.

What Should Be Done With the Interstate Commerce Commission

Excerpts from Annual Report of President Samuel Rea of the Pennsylvania Which Advocates Regulation of the Railways by a Properly Organized Commission

Weak railroads are among the greatest obstacles to business enterprise and commerce, and the country will have too many weak railroads unless a constructive and equitable policy of public regulation is practiced, not as a palliative, but as a permanent public and business necessity.

Samuel Rea, President Pennsylvania Railroad System.

Stating that there remains a great deal of constructive work to be accomplished before Governmental regulation of railroads—State and Federal—is placed on a satisfactory basis, Samuel Rea, President of the Pennsylvania Railroad Company, in the Sixty-eighth Annual Report of the company, makes what the *New York American* has described as "epochal suggestions." He said:

"The increased scope and great burden of the duties and responsibilities imposed upon the Interstate Commerce Commission should now be followed by the amendment of the Federal laws from which its authority is derived. The Commission should be definitely empowered, by specific provisions in these laws, to strengthen the railroads, upon which the welfare of the country so largely depends, so as to encourage the investment of private capital for the expansion of their facilities and services, and the preservation of their credit by means of reasonable rates which will accord with the higher costs and burdens placed on them in complying with statutory requirements and Governmental awards and regulations.

"The Commission should be enlarged and so organized as to be able to deal promptly with the important railroad questions which under the existing scheme of Governmental regulation must be considered by it. The position of a Commissioner should be placed beyond political influence by a long tenure of office, and the compensation should be sufficient to attract and retain men of the widest experience and greatest ability. The regulatory power of the Commission should be clearly extended to the supervision and control of all rates and practices which directly or remotely affect interstate transportation or commerce, and should include power to maintain a rate structure approved by or satisfactory to it, even though to accomplish this is should be necessary to prevent reductions of rates or to compel advances of rates found by the Commission to be unreasonably low. An unreasonably low rate may be beneficial to some one or more shippers, but the rates of some other shippers are sure to be disadvantageously affected thereby.

"The services of the Commission should be made available to remedy the concededly inadequate revenues of the railroads for the transportation of mails and parcel post, and the power of Commissions, State and Federal, to suspend increases in rates should be limited, so as to prevent loss of revenue to the railroads during the suspension of rates subsequently determined to be reasonable. Increases in wages and other burdens which seriously enlarge railroad expenses should not be imposed by legislation, or through awards of Governmental bodies, unless the ability of the railroads to pay the same under the rate schedules then in effect is clearly apparent, or unless the Interstate Commerce Commission is prepared to approve of increases in the rate schedules that will enable the railroads to meet the same without impairment of their credit or efficiency."

The Valuation of the Railways

The Fourth Paper Descriptive of the Work of Taking the Physical Valuation of the Common Carriers

By H. H. Edgerton, Assistant Engineer Chicago Great Western

It is reported that the U. S. Government valuation field party on the Indian Territory Division C. R. I. & P. Ry. made as high as 10 miles in one day, measuring, cross sectioning and taking up track valuation; that they turned in from 60 to 90 miles per month; that their daily average working day was from 3½ to 4 miles per day. This is remarkably speedy work.

On the other hand it is reported that the whole six government parties in the eastern division only did 86 miles in the season. It is quite likely that there are some reasons not presented as to why there is such a difference in speed. The eastern roads are older. There is much more to one mile there than there is to ten miles of a comparatively new prairie road. There is much more hidden under the ground, much more to be looked after in an old eastern road, but even then there is hardly reason to expect that one party in the middle west should be able to accomplish more in one month than six parties in the east do in one year.

At any rate, this is only cited as an example, and it is not intended to say that it is the fact in this case. But let that be as it may, it has occurred elsewhere than in the government work of valuation. The railroads themselves have had just as appalling differences in the results of their own parties.

Most of this disparity in the speed of the results comes from lack of standardization of the work. There are lots of good engineers, designers, builders, locators, who do not know how to push a party in the field along a track; push them and push them hard, get speed and a reasonable accuracy. From engineer down to chainman they generally lack a standard of accuracy and a standard of speed. I have known one set of chainmen doing a prodigious amount of mileage, by the head one spitting tobacco juice on the snow for a mark, and the rear one stepping on the tape for a halt and measure. If there is not some certain degree of speed and accuracy to work to, some parties will be sweeping along a line like a prairie fire while others will be hanging back fiddling time on some niceties that will not add a thousandth of one per cent to the value of the road. And speed is a very requisite thing in valuation. As it should be required, it is desired to get the value of the road as it existed in a certain year. Therefore such a number of parties should be put in the field, and such a standard of speed and accuracy maintained that a uniform valuation may be obtained in one year.

By far the largest part of the work outside the office compilations is the work of the field parties doing the measuring and the cross-sectioning for the cuts and fills, and it is often a difficult proposition to get a number of engineers together to take charge of these parties whose ideas of speed and accuracy are all alike, and before they are sent out the chief in charge should see that they are alike to assure a uniformity of time and results. One of the best methods is to get a mile, or better 5 miles, of road near some convenient headquarters accurately measured in quantities and length, and on this mile test out and instruct each organized party. This should be an average piece of road, presenting as many different kinds of cuts, fills, sidings, bridges, etc., on a small scale as possible. In preparing the quantities of yardage cross-sections should first be taken every ten or twenty feet, so as to be perfectly fair to the engineers who are tried out on this strip to see within what limits of accuracy their work is. In other words, have the standard correct before the field trials. The distance should be measured with a spring balance tested, temperature adjusted, tape, otherwise it is not fair to call one set of chainmen any better than another. If the work is such that the parties cannot be brought to a central point for testing and instruction then a special high grade party should make the rounds and spend a few days with each of the other parties and lend a hand to show them how to attain greater speed, and yet keep within certain limits of accuracy. To have one experienced man make the rounds will help some, but an entire party of specialists is much better. Then those under instruction can see them work together as an organization, an organization in which each knows what to expect from another, what to do and how to do it, and they work together like a charm, and roll off mile after mile all within a certain limit of definite result.

CHAINING

Take such a simple matter as measuring. It is one of the first requisites in valuation to have every hundred feet marked in yellow chalk on the flange of the rail, every thousand feet in a white enameled paint mark that will not fade or wash out, and the plus to every object intended to be noted. Two chainmen and a recorder are necessary for this. The chainmen cannot do it alone economically. The engineer should know both their temper and speed. It is well not to let them get out of hearing or sight of the rest of the party. They will likely make a mistake in numbering the stations during the day, and they will need to know it so as not to continue it on. Some sets of chainmen will sail way ahead of the party, spend the afternoon under some shade tree or in a saloon, and a year later be boasting of what an easy time they had under "the old man." If they are really so speedy and reliable they need only chain every other day, and the alternate days can help the cross-section party, or stay in the office to calculate quantities.

CROSS-SECTIONING

In the matter of cross-sectioning for valuation the standards of different engineers presents a wonderful jumble, a crazy quilt of ideas, a good many of which could be made uniform if they would think for themselves. What is the use of reading to tenths of a foot at the even stations if in between there is a difference of a foot in the elevation of the fill. A squint across the rails is generally near enough. The rails are level on a tangent. Put it down what it appears the nearest and the quickest,—what is first seen at one glance, only don't put down such figures 6.5 or 8.3, use only the even tenths, if you can see to tenths quickly without a hand level; for these figures likely have to be afterwards added and divided in calculating the quantities, so it is useless to put down something that will bring hundredths when divided by two. True a hand level is a sort of an accepted thing, much beloved, caressed and tenaciously hung to by the average engineer, but what we want here is speed and a certain degree of accuracy. There is not time to dwell on these jobs while the years roll by. The job must

be finished within a year. Neither the corporations nor the government has the money to pay for it if dragged out. We must drop our hand levels in places where we can squint across the rails, though it breaks our heart to do it, to part with our beloved instrument, and what engineer does not feel like a fish out of water unless he has some piece of brass about him—a "doodad with a bubble in it?" But a new order of things has come to pass; a new requirement has come upon us, and we must adapt ourselves to those conditions. If we stop to think what we used the hand level for most of our lives was for setting slope stakes. Those stakes were set to be afterwards measured down from or up from by the contractor; hence, it was necessary to have them set to tenths. In valuation no such necessity exists. It is entirely without the limits of expense to take cross-sections at but few of the plusses, yet in the hundred feet there are often differences of a foot in the elevation of a fill. Why then should we read to tenths at the even station. Yet this old system hangs to engineers like spots on a leopard.

THE TAPE LINE

Likely many engineers cross-section in valuation work as accurately as if they were setting out slope stakes for new work. A twenty-foot rod is a mighty handy thing especially the tape fastened in a hook in the top of that. One can hold the tape even on quite a slope before the error becomes a foot or over. When it can't be reached by this method, the right of way fence is generally accurate enough to measure in from. If the rod has some huge foot figures on it the sight can be taken as the distance out is measured, and the party becomes a procession down the line, instead of a fixture for one afternoon on one piece of slope. Accuracy is mostly a matter of judgment as to where the rod should be held. To increase the cross-section party to five men will in a number of cases more than double the amount of ground covered. This allows for two rodmen, one on each side of the roadbed, a tapeman in the center, a recorder and a "squinter" to read the rod. To make this increase it will often do to call back the two chainmen on alternate days.

LIMITS OF SPEED AND ACCURACY

As stated, the U. S. Government party on the C. R. I. & P. made as high as 10 miles a day cross-sectioning. The Rock Island road's pilot engineer, who accompanied them, held back the original notes of the road when it was built. When he compared them with the results of quantities of yardage obtained by the United States valuation party they were within 5%. And this is not saying the valuation party was in error 5%. The engineers who laid out the original construction may have been wrong. But it shows how great speed can be obtained and yet the results be within a reasonable degree of accuracy.

ASSEMBLING DATA

The United States valuation division has been doing a very good thing in instituting the loose leaf carbon paper system. In this way two sets are kept,—made at the same time. This also hastens the calculation of the yardage, that bug-bear of rainy days and long evenings. With duplicate and triplicate sets of notes more "working surface" so to speak can be obtained and all hands set at it when the weather is too bad to be out. In addition the railroads who furnish a pilot engineer are offered the courtesy of a full copy of the notes. Another good thing they have instituted is that these notes are taken on cross-section paper and plotted as they go. It is a delight to see the old system of the sheepskin field book given a jolt. Roads and engineers have hung to this relic as tenaciously as to the hand level, sometimes simply the purchasing agent demurs when anything new is asked of him. We will be glad to see this ancient hide bound sheepskin covered field book thrown into the museum of the has-beens along with the link chain, jacobstaff and compass.

As the quantities are calculated it is well to put them at once on a profile of the line. If a profile cannot be obtained, to plot one is but a half hour's work a day. This need not be a profile from levels; the grade can be taken as a level line and the cuts and fills plotted above or below. But it is very handy to have to put the quantities on, and divide them into miles. If they are not put on a profile where they can be inspected by eye there is apt to be an overlap or an omission. The profile costs not 30 cents a mile and may save hundreds of dollars in an error.

THE EQUIPMENT OF THE PERSONNEL

To say anything about what kind of socks or boots or drawers a person wears may seem trivial, but the engineer who neglects to see these things looses a day here and there. I know of a lad who was suddenly called out of an office to be rear chainman, and they handed him 12 miles the first day. That meant he had to squat down and get up 1,272 times, and his drawers rubbed his legs bloody at the knees. The drawers should either be skin tight or not work when the trousers do, or that many rubs will get the hide of the toughest. And again, twelve miles over slag ballast will cut the soles off the best of shoes. In this case it was amusing to see the whole party hunting a shoe shop in the little town where they arrived the next day at noon, and they did not get to work until 4 p. m. Remedy, have hob nails or spikes in the boots.

I once came upon a cross-section party whose members had no spike boots. They were like a lot of teetertails, unsteady and could not keep their footing, pulling one another up the bank with rod and chain. When one has to climb up and down, up and down the slopes all day real spike boots are essential. The tired legs cannot stand many slips. What are known as 0 or 00 loggers screw calks are the things. These will save hundreds of slips during the day time, and can at a pinch be unscrewed at night and taken out if it is desired to go to church or to a dance.

TREATMENT OF THE MEN

There are survey parties the individuals of which will most kill themselves to do all they can for the sake of the "old man," the boss they like so well, while on the other hand there are survey parties where antagonism has come up between the boss and the subordinates, and then the latter glory in doing as little as possible. Perhaps the men are not fitted for the work, perhaps the boss is in the wrong business. But what it is that conduces to a spirit of harmony and an eagerness to work must be figured out by each chief of party for himself. There is no rule for success in handling humanity. However, there are some little things that must not be overlooked.

The "tie-up" at night, the location of the bunk car or the town they are to stay in is a very important thing. The engineer should so arrange the day's work that there will be no big walking to do at the close. All the spare steam should be used to get figures. It never counts for much glory that they are able to race in six miles at the close of the day's work. We all know we are great walkers as a class, but to continue to show it off is folly, yet some engineers keep a cross-section party, and some only a sort of a human racing stable.

And then again the men are not camels, they must have water, and like an army they "travel on the belly." It is a pity how many well trained technical engineers are contemptuously spoken of as "Old Prunes," or here comes "His Dried Apple Highness."

It is well to so conduct one's self that the men see the best efforts are being put forward to provide suitable

food and suitable places to sleep. An indifference to this has killed many a technical career.

The following is a description of a field party on one of the big railroad systems of the country, as given by Mr. H. R. Barnes:

Two chainmen and a recorder marked the stations on the inside of the rail, and these were followed by a cross-section party, the latter consisting of an instrument man, rodman and tapeman. Their equipment consisted of an Abney slope level, rod, chain and tape, and blue prints of alignment, profile and station maps. These maps and profiles can generally be had on most railway systems. While not absolutely necessary they are a great aid. Sometimes the cross sections were only taken every 400 feet, but oftener if necessary. Sections through large cuts and fills were taken by measuring the lengths of the slopes and the slope angles. Diagrams were used to get the correct horizontal distance. Clearing and grubbing were noted in terms of per cent as related to the width of the right of way. All plank, track drains, cut and berm ditches, channel changes, pipe, culverts, etc., etc., were also noted and measured by this party. A material man and a tapeman trailed after the cross-section party and in addition to note book carried with them a set of blue prints of track standards. He classified all rail, rail fastenings, ties, ballast, signs and fences, and noted the stations of their respective changes.

LOCATION	LENGTH	RAIL	JOINT	TIES	BALLAST	TIE PLATE	SWITCH		SW. STD	HD. BLK	FROG	GD. RLS	RL. BRS	REMARKS "SHOP YARD"
39/0+00				Sel 9 Fir			15-65 S.S.w		1 N	2-8-8 +14-0	7-60 R	2-10 60		
39/0+00 to 50/1+32	133	65	Ang B	100% Cedar	12" Cind	11							3	
50/1+32				7/8 Fir			15-65 S.S.w		1 N	1-14-14 +14-0	7-63 R	2-12 60		
50/1+32 to 80/11+42	1010	65	Ang B	100% Cedar	12" Cind	15							3	Deduct 66' of length on ballast and tie calculation.
80/11+42				7/8 Fir			15-65 S.S.w		1 N	2-8-8 +14-F	7-63 R	2-12 65		
80/11+42 to 70/2+65	877	65	Ang B	100% Cedar	12" Cind	12							4	
70/2+65				7/8 Fir			15-65 S.S.w		1 N	2-8-8 +14-F	7-63 R	2-10 60		
70/2+65 to 90/3+97	133	65	Ang B	100% Cedar	12" Cind	12							5	
90/3+97				7/8 Oak			15-65 S.S.w		1 N	2-8-8 +14-0	7-63 R	2-12 65		
90/3+97 to 100/12+80	883	65	Ang B	100% Cedar	12" Cind	10							–	
100/12+80				7/8 Fir			15-65 S.S.w		1 N	2-8-8 +14-0	7-63 R	1-14-14 +14-0		
100/12+80 to 105/13+60	81	65	Ang B	50% Cedar 50% Oak	12" Cind	8							4	

Leaf from Special Book of Field Notes for Yard Valuation.

The bridge and building department was represented by a building inspector and an assistant. They took measurements of all buildings, and made a detail statement of the classification of the material that made up the structures, in addition to inventorying and classifying all such mechanical apparatus and accessories that pertained to their department.

An assistant engineer was in charge of all these sections of the valuation party and made it a point to interview such local employes of the road who might throw light on those features of the construction of which there was no existing or apparent evidence.

Under this organization the party made from 3 to 7 miles per day, depending on the topography of the country.

The equipment of the party, crude as it was, is capable of registering measurements to a degree of fineness not essential to this class of work; and unless a party of this kind has had sufficient experience to recognize the full meaning of the word estimate as applied to valuation much time would have been wasted. Experienced men will readily recognize what is standard width of roadbed of each particular line, and any variation will be seen and noted without measuring. As the party gets more practiced numbers of cross-sections on light work can be noted within an error of less than a foot by inspection. In working large cuts and fills much time can be saved by providing each member of the cross-section party with a hand level. They only cost $5 apiece, and probably a hundred times a day save waiting till another man moves into position. A small card with slope angles most commonly encountered and the corresponding distances out from the center was found very handy to save pegging up and down long slopes and breaking chain.

In collecting track material notes much valuable assistance can be obtained by properly approaching the section foreman. Where possible the section foreman should accompany the material man over his section, and will be a great aid to the party by calling attention to changes in material and its age, and also the many kinds of covered work hidden to the eye.

In the collection of material notes in large yards the latitude and departure system was found the best. Every item, frog, switch, beginning of track, end of track, etc., was given a northing and a westing, marked on the rail in yellow chalk by a transit party. This prevents duplication and omission. The system of numbering should be reproduced also on a blue print of the yard for a check.

Inventorying for valuation of grading, track material and the like is a branch of the profession comparatively new, and has not yet reached that stage of uniform method common to the other branches. To make a just inventory within limits of cost depends mainly upon the chief of party. He should be a thorough railroad man, experienced on location, construction and maintenance, and should have the ability to recognize the features so easily overlooked, such as slides, sink holes, work done off the right of way, town grading, swamp drainage, jetties, and the like, and to look up and locate some local authority to verify his suppositions. The records in the companies office never tell the whole tale. He should be a man of sufficient experience not to waste time on details, and whenever unanswerable questions arise will give the railroad the benefit of the doubt and move on. The money spent by a railroad can never all be accounted for.

Interesting Legal Decisions

What the Courts Have Decided on Questions Pertaining to Railway Engineering

Interesting Recent Legal Decisions

What the Courts Have Decided on Questions Pertaining to Railway Engineering

Our legal department has made a careful analysis of the recent court decisions and the result is given herewith for the benefit of readers of RAILWAY ENGINEERING. *All necessary references to court records are given in each case. Any further information concerning these cases will be gladly furnished.*

DUTY TO OPERATE RAILROAD.

(Federal, Southern Iowa.) While as a general rule it is the duty of a railroad company to maintain its entire line of road in a reasonably safe and operative condition, and to operate the same, there may be conditions which will excuse the full performance of this duty, and justify the abandonment of a branch or connecting line which cannot be operated without great loss and for which there is no great public necessity. Defendant railroad company owned and operated an electric line of road 125 miles long which was of large public importance. It also

owned and operated by steam a connecting line 27 miles long which was not equipped for operation by electricity. This line was little public necessity for its operation. It did not pay operating expenses, was in a dilapidated and dangerous condition for use, and required the expenditure of a large amount of money to rehabilitate it. Defendant was hopelessly insolvent, and a suit for foreclosure of mortgages on this property was pending in which receivers had been appointed who had operated the steam line at a large loss, and under an order of the court had tried unsuccessfully to sell the same. Neither defendant nor the receivers could obtain the money necessary to put it in safe operative condition and to require its operation by any purchaser of the entire property would seriously embarrass, if not prevent, the successful operation of the electric line. Held, that under such conditions neither defendant nor purchaser was under the duty to continue to operate such line. (State of Iowa v. Old Colony Trust Co. of Boston, 215 Fed. 307.)

RESERVATION IN GRANT TO RAILROAD COMPANY.

(New York.) The rule that if one conveys land, leaving other land belonging to him to which he can have access only by passing over the land granted, a way of necessity is reserved in the grant obtains though the grant is for a railroad right of way. (Heaton v. New York Cent. & H. R. R. R. Co., 149 N. Y. S. 71.)

INJURY CAUSED BY BROKEN RAIL.

(Oregon.) In an action for injuries to a passenger, an instruction to the jury that a railroad carrying passengers is not an insurer against accident nor responsible for accident which is unavoidable, but is held to the utmost care which can be exercised by human prudence, skill, and diligence, is not error. (Graham v. Corvallis & Eastern R. R. Co., 142 P. 774.)

OBSTRUCTION OF WATER COURSES.

(New York.) Where a railroad under authority of law builds a bridge, it is not liable for an obstruction even of the bed of the stream, unless by due care obstruction could have been avoided, but it is bound to minimize the interference with the flow of water so far as it reasonably can; this duty being confirmed by Railroad Laws 1913, c. 284, section 17. (Howard et al. v. City of Buffalo et al., 105 N. E. 426.)

CONDEMNATION OF RAILROAD RIGHT OF WAY.

(Pennsylvania.) It is essential to the condemnation of land for a railroad right of way that there shall be a preliminary survey made and reported with necessary maps and profiles, and the selection and adoption of a surveyed line by the directors for the location of the proposed railroad, and that the owner shall be compensated for damages sustained. (Johnston v. Delaware, L. & W. R. R. Co., 91 A. 618.)

ELEVATION OF GRADE CROSSINGS.

(Illinois.) In the exercise of its police power, a city may, subject to constitutional limitations, require a railroad company to elevate its tracks so as to avoid grade crossings. (Otis Elevator Co. v. City of Chicago, 105 N. E. 339.)

SUGGESTIONS FOR TRACK SCALE SPECIFICATIONS

The following suggestions of track scale specifications are intended to be substituted for the corresponding section numbers of the American Railway Association.

4. Scale Design.
   a—Scales should be designed so that the load is suspended from (and not superimposed on) the main supporting levers by means of members having common rotation centers below levers, permitting equalization of load upon pivots, prevent displacement of bearings and not impede upon the axial motion of main levers, nor introduce effects from deflection of girders under loads.

   This description establishes a truly independent suspension bearing, does not favor existing patents and does not debar competition.

   b—They should be constructed in not more than four sections, *when the length of weigh rail does not exceed 60 ft.,* above 60 ft. 6 sections are permitted.

   c—In scales of more than two sections articulated girders, etc. This limitation should be struck off because it favors a patented article, weakens the lateral stiffness of platform, introduces error by changing balance of platform upon lever system. Should read: Instead of articulated girders, beams of extra heavy section should be used, which under a maximum load of 100,000 lbs. uniformly distributed over a span of 17 ft. do not deflect more than 0.1 inch, this deflection to be compensated by design in equalizers supporting platform upon lever system. The hinge joint being located above bearing causes instable results in the lever setting; they may be permitted if designers will place joint centers below pivots of main levers.

   d—The American Railway Engineering Association should furnish manufacturers plans of foundation to enjoy fair competition.

2. The multiples 3, 8 and 8⅓ to draft rod are not economically selected, 4, 12½ and 4 instead would ideally deposit the bulk in low and crude stages upon the foundation, relieve the higher levers from useless weight and not sacrifice any advantage, because in either case the total multiplication is the same, namely, 1,200.

5. Capacity. Remove in present form.
   a—Should read: The capacity of scale shall be termed 150 ton, one-fourth of this amount or 75,000 lbs. to be placed as a static load on each of the eight main levers shall not produce knife stresses greater than 6,250 lbs. per linear inch and deflections in levers not greater than one-two thousandth of span, allowing fiber stress of 2,500 lbs. for cast iron tension, 5,000 lbs. for cast iron compression, 7,500 lbs. for cast steel tension, 8,000 lbs. for cast steel compression, 8,000 lbs. for structural steel.

   b—Main levers, material and design should be left to individuality of the manufacturer, and meet above capacity and stresses.

8. Grade.
   a—Last sentence: Grade blocks introduce a multitude of extra parts, which can be overcome by design in four pairs of yokes by following bridge construction.

9. Foundation.
   c—Read: The rail stands or pedestals instead of scale stands.

10. Installation.
   d—Steel ties should be mentioned and recommended. There is no installation with wood ties which does not show crushing of ties and assumed relief is is only an illusion.

   h—The use of extension levers between fifth lever and scale beam is not permitted.

   e—Clearance between the movable parts and fixed parts adjacent shall not be less than one-half inch.

Rating for Load Capacity of Track Scales

The Lack of Suggestions for a Definite Rating of a Track Scale and a Suggestion for a Uniform Classification of types

By W. Samaus, Assistant Engineer, Bessemer & Lake Erie

In the various specifications for track scales put forward in late years, and in recent discussions on the same subject, there is a noticeable lack of suggestions for a definite method of rating a track scale according to its service and load capacity: a rating that shall be applicable to all track scales, no matter what the length, the number and arrangement of sections, or the overhang may be.

Nor is there any recourse to a brief terminology that will define the classification of a track scale with respect to its principal measurements, similar to that used in denoting the type of a locomotive.

The purpose of this article is to show an analysis of theoretical loads produced on actual scales by typical cars, the discrepancy between the loads used in scale design by the present methods of scale rating, and the loads produced by such typical cars, and hence the need for a typical car loading that may be used in the design of track scales, and whose use shall result in placing all scales of like service capacity in the same class.

This typical car loading should be synonymous for the service rating of the track scales, in order to serve alike the purpose of the scale purchaser and scale designer.

The preparation of the matter contained in this article had been completed when the discussion on track scales by A. M. Van Auken was published in *Engineering* for January, 1915, but the other papers referred to in this discussion formed the basis for the suggestions following herein.

In Mr. Van Auken's discussion there is suggested a wheel load of 22,500 lbs., and a typical four (4) axle hopper car (very nearly the same as the 92 ton gross weight hopper car shown in Figure 5 herewith) to be used in designing scales; but there still seems a need for an answer to the question, "What Is the Rating of a Track Scale?"

For the purpose of this article it was not thought necessary to go outside of the material at hand, as minor inaccuracies would not affect the validity of the proposition as a whole.

The data collected includes a list of cars of various railroads, with data for each car on the axle and truck spacing, length over end sills, weight of car, rated capacity and gross weight (allowing 10% for overload), and a list of track scales in use (whose measurements were on file, or in publications on hand) with data for each scale on the length between sections, and length of weigh rails. Seventeen scales were selected from this list. In the tabulated values the typical cars only are listed, and the last three items of the scale data are omitted. However, there is a reference list attached giving additional information of this kind for the typical cars and for the larger and heavier cars only, the index numbers being identical with those in the tables.

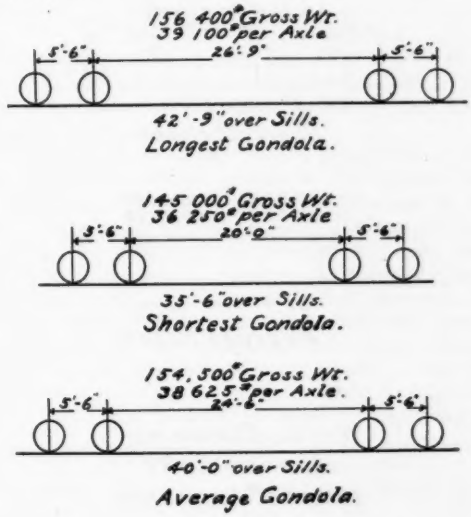
The first consideration in determining the proper rating for a track scale is the adoption of a typical loading, which need not be an actual car diagram, but merely a suitable unit.

For the purpose of suggesting such a loading there were selected from the original list of cars typical diagrams of each of the following classes: Gondolas, hoppers designed for coal and ore, hoppers designed for coke (also known as bin cars); all of the above for 100,000 lbs. capacity, and shown in Figures 1 to 4 respectively. Each sheet shows the longest, shortest and average wheel base for each type of car, where the difference was sufficient to make it of interest. Only one ore hopper is shown, and the longest and shortest coke hoppers.

Figure 4 shows some extra heavy types of cars now in use.

Figure 5 shows diagrams selected as typical 4 axle cars, after consideration of the cars shown in Figures 1 to 4, to be suggested as loading types for track scales.

Figures 6 and 7 show the moment diagrams for these loading types.



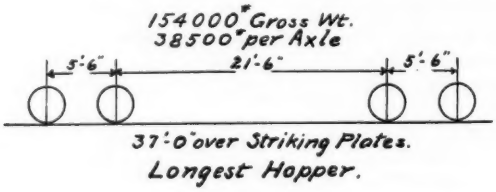
WHEEL DIAGRAMS.
GONDOLA CARS
100000# CAPACITY.

FIG. 1.

Figure 8 shows the moment diagram for a typical car of 150 tons gross weight, on two six wheel trucks. As far as could be determined the loading per axle has reached its practicable maximum at 50,000 lbs. plus its share of the ten per cent overload in car capacity usually permitted, so that the six wheel truck would most likely be used on cars over 100 tons gross weight. While larger axles may be designed, the track structure should also be considered as a limiting factor.

The above suggested loading types are not put forward as examples of actual cars in existence, no more than Cooper's engine loading is a wheel diagram of an actual locomotive, but to serve as a basis, if found acceptable, for calculating strains in scale parts. The results indicate that the type shown in Figures 5 and 6, that is, a car of 100 tons gross weight, serves very well as the unit load for which the nominal rating of the scale may be identical, as will be discussed more fully below in reviewing the figures given in Table A.

The above typical loadings might have been applied to spans of various lengths and resulting loads on sections shown, but it was thought that figures for scales actually in existence, showing the proportion of the total load that may come on each section, might be of greater interest. Considerations developed under actual tests as indicated in the papers referred to show that the continuous action over supports of the weigh bridge or stringers materially modifies the distribution of load obtained when the stringers are considered as simple beams between each pair of sections, but this does not affect



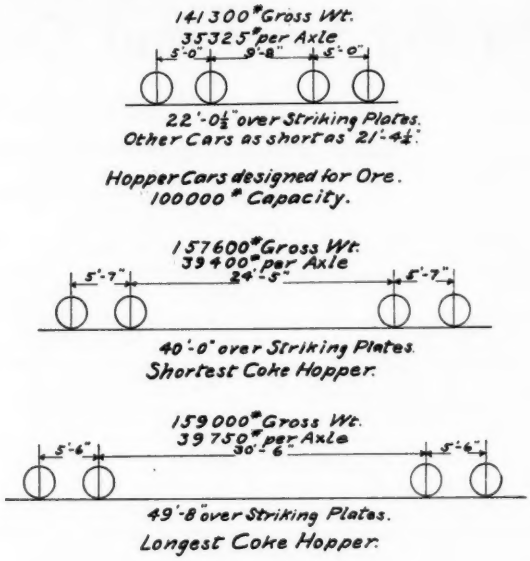
WHEEL DIAGRAMS
HOPPER CARS
100000# CAPACITY.

FIG. 2.

the use of the tabulated figures, for a factor sufficiently large (20 to 25%) can be added in each case if its value is positive, to make up for any continuous action there may be; and when there is an uplift at any section, it need not be considered, if after impact allowance has been made the total is less than the dead weight on the section considered. If such uplift plus impact allowance is found to exceed the dead weight, it seems desirable to use articulated weigh bridges rather than to add dead weight at the sections where uplift occurs.

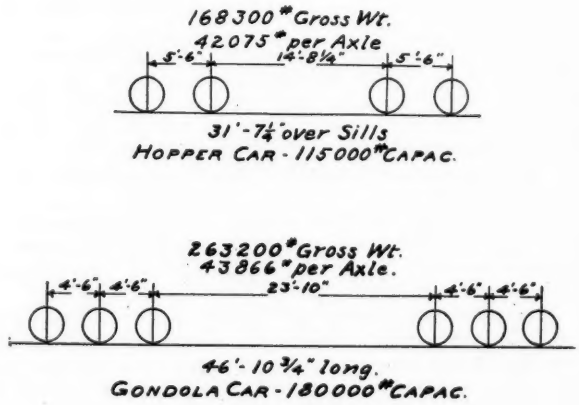
From the plans of track scales on file, and from those shown in the publications on hand, seventeen different scales were listed.

In order to list these scales in proper order it was found advisable to use a terminology that would include certain variables pertaining to each scale in the first column, namely, the distance from center to center of end sections, the number of sections, and the length of weigh rails, in the order given. Thus a 58-4-50 scale indicates a scale 58 feet center to center of end sections, four sections, and 50 feet length of weigh rail. The overhang for this scale is 4 feet, this value being the same at both ends of all the scales considered. The overhang considered is the distance from end of weigh rail to center of



WHEEL DIAGRAMS
HOPPER CARS DESIGNED FOR COKE.
100000# CAPACITY.

FIG. 3.



WHEEL DIAGRAMS
LARGE CAPACITY CARS.

FIG. 4.

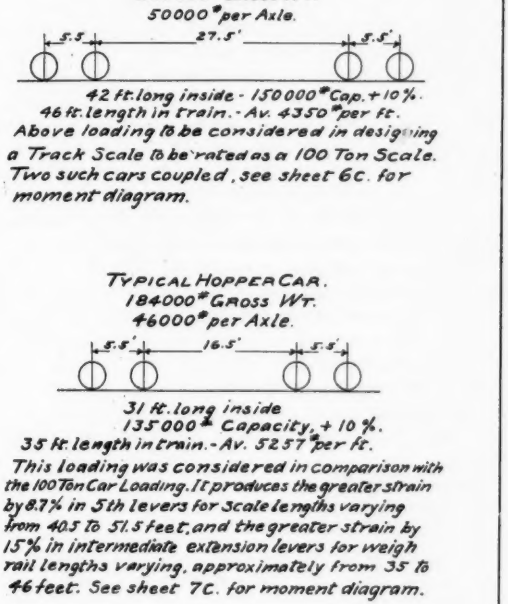

TYPICAL GONDOLA CAR.
200000# GROSS WT.
50000# per Axle.
5.5'
27.5'
5.5'
42 ft. long inside - 150000# Cap. + 10%.
46 ft. length in train. - Av. 4350# per ft.
Above loading to be considered in designing a Track Scale to be rated as a 100 Ton Scale.
Two such cars coupled, see sheet 6C. for moment diagram.
TYPICAL HOPPER CAR.
184000# GROSS WT.
46000# per Axle.
5.5'
16.5'
5.5'
31 ft. long inside
135000# Capacity, + 10%.
35 ft. length in train. - Av. 5257# per ft.
This loading was considered in comparison with the 100 Ton Car Loading. It produces the greater strain by 8.7% in 5th levers for scale lengths varying from 40.5 to 51.5 feet, and the greater strain by 15% in intermediate extension levers for weigh rail lengths varying, approximately from 35 to 46 feet. See sheet 7C. for moment diagram.

FIG. 5.

end section and not to end of pit, as it is usually shown on plans. This method of listing a track scale seems to be the simplest one, in order to give the essential data, when comparing different scales, without needing further reference to plans. When in addition the loading is given for which this scale was designed, based on a standard typical loading as suggested above, the number of a scale given as 58-4-50-C-150 has a definite meaning to anyone acquainted with this method of rating.

The differentiation when designing, between legitimate use and unavoidable abuse of track scales made in Mr. Van Auken's paper, is right to the point, and leads to rational results.

The impact factors that should be used in determining the total load calculated for each section are a part of the subject exterior to the purpose of this article, but they

MOMENT DIAGRAM TWO 100 TON (GROSS WT.) CARS.

	137.5	1512.5	192.5	2677.5	3362.5
150	12.5	100	7.5	5.0	2.5 Wt.
Wt. 2.5	5.0	7.5	10.0	12.5	15.0
1 (2.5) 5.5	2 (2.5)	Tons per Axle, or Thousands of Pounds per Wheel. 27.5	4 (2.5) 5.5	5 (2.5) 7.5	6 (2.5) 5.5
Ft. → 5.5	33	38.5	46	51.5	
51.5	46	18.5	13.0	5.5 ← Ft.	
3362.5	2075	925	462.5	137.5	
2677.5	1512.5	512.5	187.5	137.5	
1925	962.5	137.5	187.5	512.5	
1512.5	687.5	137.5	462.5	925	
137.5	687.5	1512.5	2525	3675	
137.5	962.5	1925	3075	4362.5	

Moments are given in thousands of Lb.-ft. for 1 Rail only

FIG. 6.

MOMENT DIAGRAM TWO 92 TON (GROSS WT.) HOPPER CARS. SHOWN ALSO ON SHEET 5C.

	126.5	885.5	1265.	1955.	2587.5
138	115	92	69	46	23 Wt.
Wt. 23	46	69	92	115	138
1 (23) 5.5	2 (23)	Tons per Axle, or Thousands of Pounds per Wheel. 16.5	4 (23) 5.5	5 (23) 7.5	6 (23) 5.5
Ft. → 5.5	22	27.5	35	40.5	
40.5	35	18.5	13	5.5 ← Ft.	
2587.5	1656	851	425.5	126.5	
1955	1150	471.5	172.5	126.5	
1265	632.5	126.5	172.5	471.5	
885.5	379.5	126.5	425.5	851	
126.5	379.5	885.5	1564	2369	
126.5	632.5	1265	2070	3001.5	

Moments are given in thousands of Lb.-ft. for 1 Rail only.

FIG. 7.

Considering now the values for the proportion of total loading that comes on each section of the various track scales considered, shown on Table A, attached to this report. The heading of the various columns are self-explanatory. The figures given in columns 4 to 10 inclusive are those for loads on sections and therefore apply to main levers only. These indicate that between a 92 ton (gross) short hopper car and a 100 ton (gross) longer gondola car (the maximum load being obtained on any one section when the adjacent trucks of two coupled cars are considered), there are only a few cases where the loads produced by the shorter hopper car approach the values deduced for the 100 ton gondola car, and no case where the latter values are exceeded by the former loading. However, in considering the design of intermediate extension levers and fifth lever the 92 ton hopper car produces a strain of 9 to 15% greater than the 100 ton gondola car, and in such a case the spacing between the trucks might be made less, but preferably the same 100 ton 4 axle car should be used in designing such intermediate extension and fifth levers, adding 15% to the loading.

It would be unfair to design the main levers and extension levers on this increased loading. The increased loading would only apply on intermediate extension levers

MOMENT DIAGRAM FOR 220000# CAPAC. GONDOLAS - 300000# GROSS WT.

	187.5	375	2250	3750	3937.5	4687.5	5250	6187.5	
225	200	175	150	125	100	75	50	25	Wt.
Wt. 25	50	75	100	125	150	175	200	225	
1 (25) 5	2 (25) 5	Tons per Axle, or Thousands of Pounds per Wheel. 25	4 (25) 5	5 (25) 7.5	6 (25) 5	7 (25) 5	8 (25) 6		
Ft. → 5	10	35	40	45	52.5	57.5	62.5		
62.5	57.5	52.5	27.5	22.5	17.5	10	5 ← Ft.		
6375	4812.5	3375	2062.5	1375	812.5	375	125		
5375	3937.5	2625	1437.5	875	437.5	125	125		
4500	3187.5	2000	937.5	500	187.5	125	375		
3375	2250	1250	375	125	187.5	500	937.5		
2250	1750	875	125	125	437.5	875	1437.5		
2250	1375	625	125	375	812.5	1375	2062.5		
375	125	625	1375	2250	3312.5	4500	5812.5		
125	125	875	1750	2750	3937.5	5250	6687.5		
125	375	1250	2250	3375	4687.5	6125	7687.5		

Moments are given in thousands of Lb.-ft. for 1 Rail only.
This Car is for 100 Ton Capac. plus 10% overload. 150 T. total Wt.
Length in Train 525 ft. Average wt. per ft. of Track 5714#.

FIG. 8.

RAILWAY ENGINEERING AND MAINTENANCE OF WAY

TABLE "A" Showing the amount of weight in Tons of 2000 # that comes on the various sections of 17 different Track Scales of actual design for Typical 100 Ton Gondola Car, 92 Ton Hopper Car, and 150 Ton 6 axle Cars as the 100 Ton 4 axle Cars. Also the effect on each section, and the ratio of the loads produced by the single and coupled 150 Ton 6 axle Cars as those due to the lighter 4 axle car, for these levers.

Col. No.	1	2	3	4	5	6	7	8	9	10	11	12	13
List No.	Scale Number. Numerical Classification	Actual Length of End Sect.	Distance C. to C. Ft. & Inches of Adjacent Sections	Loads due to 1-92 T. 4 axle Gondola Car. Sect. 1	Sect. 2	Sect. 3	Loads due to 2-100 T. 4 axle Gondola Cars. Sect. 1	Sect. 2	Sect. 3	Loads due to 1-150 T. 6 axle Gondola Car. Sect. 1	Sect. 2	Sect. 3	Ratio of Loads of Col. 7 to Col. 4. Sect. 1	Sect. 2	Sect. 3	Loads due to 2-150 T. 6 axle Gondola Cars. Sect. 1	Sect. 2	Sect. 3	Ratio of Loads of Col. 9 to Col. 6. Sect. 1	Sect. 2	Sect. 3	Loads affecting 1st Lever. 100 T. 44 Car.	150 T. 66 Car.	Ratio	Loads affecting 2nd & 5th Lever. 100 T. 44 Car.	150 T. 66 Car.	Ratio	Col. No. List No.
1	28'-4-21/32	28'-3"	30	10.4 (40.3)	41.0		78.7 (39.1)	49.1		78.7 (39.1)	49.1		1.04	1.01		57	60.3	1.06				100	100	1.00	100	100	1.00	1
2	43'-4-42/32	43'-5¼"	15'-2	11.2 (39.6)	39.4	33.6	46.1 (46.6)	58.0		46.1 (46.6)	57.3		1.14	1.01		921	1066	1.16				100	150	1.50	100	150	1.50	2
3	50-5-42/32	50'-3⅜"	13.0	13.2 (39.6)	44.0 (39.6)	38.1	47.8 (46.6)	55.9	59.4	47.8 (46.6)	58.3	53.6	1.17	1.15	1.10	74.4	111.5	1.50	100	137.5	1.38	100	150	1.50	100	150	1.50	3
4	43-5-46	43'-2⅛"	10.8	11.6	44.0	41.1	47.4	56.9		47.4	61.0		1.28	1.09		69.2	90.9	1.09	83.4	144.4	1.40	100	150	1.50	100	150	1.50	4
5	45-5-46	44'-9⅜"	15.4	14.0	42.7	42.4	23.5 (40.3)	63.8	54.7	23.5 (40.3)	56.9	57.5	1.18	1.41	1.42	33.4 (57.5)	80.9	1.20	96.5	122.9	1.27	100	150	1.50	100	150	1.50	5
6	54-4-46	53'-8"	18.0	17.8	41.4	40.5	47.5	61.3		47.5	61.8		1.27	1.44		67.3	87.5	1.30	98.4	128.0	1.30	100	150	1.50	100	150	1.50	6
7	54-5-46	54'-4⅝"	13.4	14.4	41.8	41.8	24.8 (39.2)	66.8		24.8 (39.2)	60.6		1.27	1.44		78.5 (66.9)	71.3		1.12	1.10		92.8	127.2	1.11	100	130.9	1.31	125	150	1.20	125	150	1.20	7
8	50-4-30	50'-3⅜"	16.8	18.0	43.1	41.8	41.6 (39.2)	62.6		41.6 (39.2)	61.4		1.29	1.45	1.36	73.5 (69.3)	87.5	1.20	1.09	1.13	1.14	71.2	79.2	1.11	100	130.2	1.30	150	175	1.17	150	175	1.17	8
9	58-4-30	57'-8"	20.0	17.4	42.1	42.1	41.5 (39.2)	64.7	44.9	41.5 (39.2)	63.6	55.4	1.00	1.37	1.40	77.4 (44.8)	87.5	1.13	1.08	1.08	1.14	80.8	87.5	1.08	100	138.9	1.39	150	175	1.17	150	200	1.33	9
10	52-4-52	52'-3"	18.4	18.4	38.5 (42.9)	42.5	47.4 (37.8)	47.6	50.4	47.4 (38.2)	55.4	55.4	1.14	1.35	1.37	68.3 (44.8)	57.5	52.2	1.11	1.14	1.13	83.4	91.0	1.09	100	142.7	1.43	150	200	1.33	150	200	1.33	10
11	55-4-52	55'-4½"	11.0	12.6	39.1	39.1	50.4 (38.2)	44.8	45.6	50.4 (38.2)	51.8	52.2	1.11	1.16	1.37	69.3 (44.8)	52.5	52.7	1.12	1.16	1.15	76.2	84.5	1.11	100	142.0	1.42	150	200	1.33				11
12	57-6-52	57'-5½"	12.2	13.4	39.7 (38.2)	38.2	43.9	46.1	48.4	43.9	52.5	54.9	1.18	1.41	1.41	65.9 (42.0)	62.3	61.9	1.16	1.15	1.13	76.7	86.0	1.12	100	142.3	1.42	150	200	1.33				12
13	64-6-53	63'-10⅝"	9.8	11.6	43.6	38.2	43.9	46.1	54.0	43.9 (42.0)	54.1	57.1	1.24	1.43	1.43	65.9 (40.0)	62.9	62.9	1.13	1.22	1.14													13
14	53-6-56	53'-04"	10.2	12.2	42.4	43.9	43.9 (40.5)	54.1	51.4	43.9 (40.5)	57.2	57.0	1.24	1.43	1.43	65.9 (40.0)	62.9	62.9	1.13	1.22	1.14													14
15	57-6-60	57'-2½"	13.4	13.2	40.4 (39.2)	40.4	45.2 (44.5)	51.4		45.2 (44.5)	57.2		1.24	1.43		65.9 (40.0)	62.9		1.13	1.22													15
16	69-6-60	68'-3½"	13.4	14.4	39.2 (39.6)	39.8																											16
17	70-6-60	70'-0"	14.9	13.0	39.8																												17

The Values for Proportion of Total Loading on Each Section of Trade Scale

and fifth levers of those scales whose weigh rail length lies between 35 and 51.5 feet (approximately).

The figures in columns 4 and 6 show in percentage of the suggested 100 ton typical loading the load on each section, as well as in tons, the load per section or in thousands of pounds the load on each main lever bearing.

For comparison with loads produced on intermediate sections, the bracketed figures show the load produced on the end section when the overhang is not taken into account; that is, as if the weigh rail was the same length as the distance between the centers of end sections of the scale. Scales Nos. 4, 5 and 14 have a weigh rail longer than the distance between the centers of end sections, and the loads produced on the end sections are consequently larger than those produced on the intermediate sections.

Comparison of the figures in columns four and six will show the need for designing scales for the loads produced by two adjacent trucks of cars coupled together.

Scales Nos. 6 and 7 furnish a very good comparison, of the load distribution obtained, between four and five section scales, and scales Nos. 11 and 12 show a similar comparison between four and six section scales, although they are not as nearly alike in length as scales Nos. 6 and 7.

Considering figures in column 6 only, the five section scales, list No. 7 gets 31% less load on the end section, and 19% less load on the intermediate section, than the four section scale of the same length, list No. 6; and the six section scale, list No. 12, gets 57% less load on the end section, and 36% less load on the intermediate section, than the four section scale of practically the same length, listed as No. 11.

These comparisons show that a four and five section scale, or a four and six section scale may have the same length and same manufacturer's rating, and yet the strain produced by the same car on these scales will vary by the percentage given.

Comparison of scales 16 and 17 shows that some variation of spacing between sections, for scales of the same length will not appreciably affect the distribution of the load.

Columns 7 and 9, table A, show the effect of a 200,000 lb. capacity gondola (150 ton gross weight) having six axles per truck on the various sections of the scales, and columns 8 and 10 show the ratio of the loads produced by this car to those produced by the 100 ton car shown in Fig. 6. For single cars only, the 150 ton car in no case produces a load on any section, as much as 50% greater than that produced by the 100 ton car; and for coupled cars, the 150 ton car in no case produces a load on any section, as much as 25% greater than that produced by the 100 ton car (20% being the maximum). However, the intermediate extension levers and fifth lever are affected to a greater degree by the loading of the two adjacent trucks of coupled 150 ton cars when compared with 100 ton cars, and for this purpose the figures in columns 11, 12 and 13 were calculated.

These show that two coupled 150 ton cars may produce strains in the intermediate extension and fifth levers as much as 43% and 50% respectively greater than those produced by the 100 ton car, and we may conclude that when a scale of 150 ton rated capacity is designed for a 4 axle loading similar to that shown on diagram for the 100 ton car, Figure 6, but with axle loading 50% greater than shown, the scale will be amply strong to weigh any 150 ton six axle car that may come into general use. But in weighing six axle cars of length shown on Figure 8 or longer, the main levers and end extension levers will have an excess strength of 20%, which excess will be decreased for 6 axle cars of shorter wheel base than the car shown in Figure 8.

Column 13, Table "A" shows that the proposed typical 100 ton car loading may transfer more than 100 tons to the fifth lever, when two coupled cars are considered, that is, it is possible to get 150 tons on the weigh rail. But to avoid having the scale beam too long or to keep the multiple of the beam within reasonable limits, the scale beam should not read further than the rated capacity of the scale based on the typical car loading used. For a 100 ton scale the beam should read to 200,000 lb., and provision should be made for hanging the equivalent weights for 50% of this amount or for 100,000 lb. on the nose iron of the beam in case special cars of long wheel base per truck were to be weighed.

In conclusion, a consideration of the above analysis seems to indicate that the use of a four (4) axle typical car loading as suggested above will satisfy the need for a common standard of capacity rating that shall have the proper meaning for either the manufacturer or user of track scales.

In short, a track scale rated by the manufacturer as a 100 ton scale will then be sufficient for weighing any car weighing 100 tons, and all wearing parts will be designed for the maximum load produced by two coupled cars, each weighing 100 tons.

Such a loading must of course be used in conjunction with a full set of specifications covering unit stresses, impact factors, materials and workmanship, and overload permissible, should provision have to be made for the accidental crossing of a locomotive over the scales.

In addition, the notation suggested for stating concisely the essential features of a track scale thus: 60-4-50-C-100, is certainly superior to naming a scale by its weigh rail length, or by the scale pit length, irrespective of the distance center to center of end sections, the amount of overhang, or the number of sections.

List and description of cars shown in Figures 1 to 4:

Figure 1. Typical gondolas, 100,000 lb. capacity.

Wt. lbs.

49′ 9″ over sills, 37′ 9″ wh. b., B. & O. R. R. 46,400
35′ 6″ over sills, 31′ 9″ wh. b., P. & R. R. R. 35,000
40′ 0″ over sills, 35′ 6″ wh. b., P. R. R. 44,500

Fig. 2. Typical hoppers, 100,000 lb. capacity.

37′ 0″ over S. plates, 32′ 6″ wh. bl., Union R. R. . . . 44,000
29′ 6″ over sills, 25′ 4″ wh. b., B. & L. E. R. R. 34,800
31′ 6″ over sills, 27′ 3″ wh. b., P. R. R. 38,900

Fig. 3. Hopper designed for ore, 100,000 lb. capacity.

22′ 1½″ over S. plates, 19′ 8″ wh. b., D. & I. R. R. R. 31,300

Above is an average length. The shortest wheel base listed is:

22′ 1½″ over sills, 18′ 10″ wh. b., D. M. & N. R. R. 32,200

Hoppers (or bin cars) designed for coal, 100,000 lb. capacity.

40′ 9″ over S. plates, 35′ 9″ wh. b., C. L. S. & E. R. R. 47,600
49′ 8″ over S. plates, 41′ 6″ wh. b., Cambria Steel Co. 49,000

Fig. 4. Heavy capacity cars.

31′ 7¼″ over sills, 25′ 8¼″ wh. b., N. & W. R. R. 41,800

Hopper car, 115,000 lb. capacity.

46′ 10¾″ long, 41′ 10″ wh. b., N. & W. R. R. 65,200

Six axle gondola car, 180,000 lb. capacity.

40′ 0″ inside length, 37′ 6″ wh. b., P. & L. E. R. R. 46,000

Gondola car, 110,000 lb. capacity.

Additional heavy capacity cars not shown on Figures 1 to 4.

30′ 0″ over sills, 24′ 10″ wh. b., P. & L. E. R. R. Not given

Four axle car, 150,000 lb. capacity.

36′ 0′ over sills, 30′ 6″ wh. b., P. & L. E. R. R. Not given

Six axle flat car, 200,000 lb. capacity.

40′ 0″ over sills, 35′ 6″ wh. b., Erie R. R. 44,000

Four axle flat (well) car, 150,000 lb. capacity.

55′ 0″ total length, 51′ 2″ wh. b., L. V. R. R. . . . Not given

Six axle flat (well) car, 290,000 lb. gross weight.

70′ 7″ platform, 64′ 8″ wh. b., A. T. & S. F. R. R. 90,000

Four truck, four axle each, flat car, 200,000 lb. capacity.

First Aid Treatment of Injured Persons

The National Affiliated Safety Organization's Standard First Air Jar. Excerpts from Papers by Magnus W. Alexander

Injuries to persons may be due to accidents such as the breaking of a machine or a tool, the spattering of molten metal or the flying of chips, or they may result from unsanitary or injurious conditions such as are caused by smoke or poisonous vapors; persons may suffer temporary disability from physical weakness or from unavoidable conditions of employment, and quite often, inexcusable carelessness of the employee may be the cause of the injury. Whatever the cause, it is obvious that an injured person should receive prompt and effective attention, sometimes to prevent graver consequences such as blood poisoning, and sometimes to save even life itself, as when the injured person bleeds excessively.

If a physician or a professionally trained nurse is close at hand, it is of course safest to turn the injured over to his or her care; in most instances, however, such is not the case. Even where doctors and nurses are regularly employed in industrial plants or are located nearby, they may be engaged upon other equally serious cases or may be temporarily absent when they are urgently needed. Often also the nature of the injury, such as severe bleeding or unconsciousness from electrical shock, demands effective treatment without the waste of a single minute, when the time lost in taking the patient to the doctor or in bringing the doctor to the patient might prove fatal. Then there are the thousands of slight injuries like cuts of the hands or irritations of the eyes, when the injured persons will not take the time or trouble to go to the dispensary in the plant or to a doctor nearby, but will use unsafe methods of self-treatment, or will secure similarly harmful attention from a co-worker, who is as incompetent as himself to properly attend to the injury. For all of these reasons, it is becoming quite universally agreed that selected persons in employment should be taught proper first aid treatment of injured or sick persons. Where it can readily be done and particularly in large establishments or where there is an unusual risk in the employment, the first aid instruction should be given by a competent physician and should be repeated periodically so as to keep the "First Aid Corps" in good practice.

First aid men are either supplanting in an effective way the slip-shod methods of the person who treats his own slight injuries or those of his fellow men, or they are doing in an intelligent way the necessary preliminary work in more serious cases, pending the arrival of a physician.

Often in order to save the expense of first aid instruction by a physician, but usually to supplement his efforts and to provide some readily available guide as to what should be done in emergency cases, first aid books are placed in the hands of first aid men. These books are sometimes rather voluminous because they go into a very complete description of the nature and character of the various injuries and ailments, point out their manifestations and, aside from giving instructions for their treatment, indulge also in lengthy explanations of the reasons for such treatment.

Bearing in mind the purpose for which first aid instructions are given and that the first aid man should never consider himself or be considered as a substitute for the physician, but rather as his emergency assistant, it would seem the wiser course to eliminate from these instruc-

tions every unnecessary word so as to reduce the reading matter and concentrate attention upon the things which should and should not be done. Quick action in emergency cases is of vast importance and no time should be lost in reading irrelevant matter or in searching through many pages of a first aid book. Finally, the instructions should specify the use of simple materials that may be readily available to first aid men and can be used safely and effectively by them. Concise instructions for first aid treatment, readily understandable by the layman, and calling only for a few commonly used materials, quite harmless in themselves, will, if properly followed, prove of inestimable practical value and eliminate much suffering.

If the uncounted thousands of injuries treated by laymen could be analyzed, the high degree of the effectiveness of such treatment would at once astonish and gratify. In quite a few instances, nevertheless, wounds even apparently slight in character which have received careful attention by first aid men have developed serious conse-

The N. A. S. O. First Aid Jar.

quences, because of under-estimation of the real extent of the injury or on account of the contributory cause existing in the impaired physical condition of the patient or for other reasons unknown to the first aid man. If these cases could be located promptly and put under medical care before they develop too far, much would be gained in still further popularizing first aid treatment by laymen. This may be done by adopting a first aid follow-up system which must, of course, be simple and inexpensive in character and practically automatic in its operation. The use of first aid record cards admirably fulfills this function. It is only necessary to provide each first aid man with a supply of these cards and instruct him to fill out one for each injury which he treats and to forward the same promptly to the general office or works dispensary of an industrial establishment or to a responsible person designated for this purpose. The record should include the name of the injured person and a brief record of the injury. The recipient of the record cards is thus afforded the opportunity of knowing exactly, day by day, who among his employees has been injured and the character and extent of their injuries; he is therefore in a position to follow up all injured persons and determine whether subsequent medical attention is needed and in that case furnish the same promptly. This follow-up system is inexpensive and wherever tried has proved very effective.

In some plants it may prove advisable to elaborate the information on the card even to the extent of calling for suggestions for the prevention of the recurrence of the accidental injury, or data may be added that will permit a study of the conditions under which accidental injuries occur most frequently. In general the simpler the card, the more surely will it be used properly.

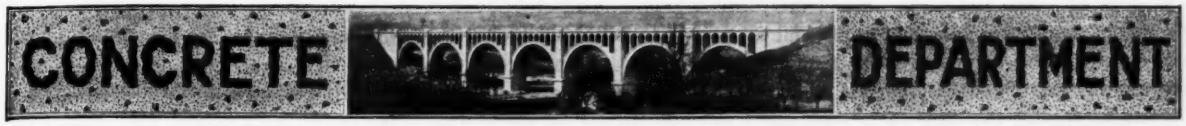
To train men in proper methods of first aid treatment of injured and sick persons, as has been previously outlined, and not to furnish proper materials for this work would be doing half a job only; to furnish the materials and not to provide for their convenient storage and ready accessibility would be doing the job in a slip-shod manner. It is therefore important that first aid materials for effective treatment of slight wounds, or for emergency treatment and serious injuries, should be furnished and kept in a suitable container in which they can be readily carried. Such first aid outfits, in one form or another, are now in quite general use in industrial establishments, in stores and offices, in schools and even in homes.

For some first aid outfits, wooden or tin boxes are used as receptacles for the materials. Wooden boxes are usually heavy and are inconvenient to carry; tin boxes are lighter in weight but are easily dented and are apt to rust. Both are open to the complaint that it is difficult to keep them clean and in good order. These outfits have the added disadvantage that their entire contents, which cannot be seen at a glance, may have to be disarranged to get at a particular article which may be at the bottom of the box.

In order to provide a more sanitary equipment, glass jars have come into use as containers for first aid materials. Their advantages over wooden or tin boxes are obvious. If properly constructed, such outfits can be easily kept clean and quick access can be had to all materials.

The N. A. S. O. Standard First Aid Jar was developed to meet all requirements of a compact, convenient, sanitary first aid outfit. The jar itself is structurally strong and is made yet stronger by a special annealing treatment. It was designed with smooth surfaces and particularly with straight walls on the inside to promote cleanliness and facilitate the removal of first aid materials. In the glass cover of the jar is molded a convenient carrying handle and the cover is securely held on the jar by suitable spring clips which are a part of a metal cage in which the whole jar sets; this metal cage affords added protection against breakage of the jar. The jar is made only high enough to accommodate the bottles of medicaments stored in it so that the stoppers cannot come out of the bottles when the cover rests on the jar. Medicine bottles, bandages, absorbent cotton, burn ointment in collapsible tubes and a wire gauze splint are set along the wall of the jar so that they are plainly visible from the outside and can be quickly located. A metal dish of special construction, placed in the inside of the jar, keeps the materials just mentioned in their proper place. The metal dish itself is used as a receptacle for other parts of the contents, such as tourniquet, medicine glass, gauze bandages, medicine droppers, spoon, scissors, etc.

A glance at the accompanying illustration and list will show that a surprisingly large number of articles are stored in the jar, which is only about 9½" in diameter, 6" high, and complete with contents weighs only slightly more than 12 pounds. Yet the jar includes every material, which a large Conference of Physicians, with extensive experience in the treatment of injuries, agreed upon as necessary for effective first aid treatment by laymen.



Progress in Concrete Design and Construction

As is the case with all new industries the progress made in concrete design and construction has been emphasized mainly by the building in large numbers of structures of the types which were among the first to be constructed by the founders of the industry. This is natural, for men are more or less creatures of habit, who for the most part do not depart much from the beaten paths of progress, unless forced by conditions to do so.

There are, however, a few men, relatively speaking, who are continually experimenting and searching for new fields and uses for concrete, and as a result new and unusual structures are constantly coming to our notice. It is to these men, whose endeavors are mostly confined to the exploitation of new types of structures, that we should really give the credit for the rapid progress in the concrete field, for as we say, after the ice is broken, it is easy for others to follow.

The unusual structures built are a forceful indication of the possibilities of concrete and very materially tend to increase its use and therefore make its progress more rapid. For this reason we publish on another page in this issue an illustrated article on "Unusual Structures of Concrete Built by Railroads," some of which merit much attention and which, no doubt, will be classed among standard designs within a few years, on account of their economy.

Concrete—Its Use in War

The great struggle which is now rending practically all of Europe and crippling industry and commerce very severely has developed many new uses for the most universal of all building materials, concrete.

We have heard much regarding the large concrete foundations necessary to support some of the great siege guns used to reduce massive forts of solid reinforced concrete, and that these foundations had been prepared many years previous in the anticipation of the titanic struggle as we are now witnessing. This last statement we prefer for various reasons to take as being the exception rather than the rule, and we have reason to believe therefore that much concrete is being placed from time to time on the battle front to serve as gun foundations. This is further evidenced by the fact that the various combatants have been in the market for large quantities of cement, which would indicate that cement forms a very necessary part of army ordinance.

A recent article in Beton u. Eisen (Oct. 5, 1914) by P. W. Scharroo of the Imperial Military Academy of Breda, Holland, illustrates how extensively concrete is used for forts, batteries, coast defenses, bomb-proofs for men and munitions and temporary shelters for field batteries and troops. Great as has been the loss of life there can be no doubting the fact that the loss would have been much greater had not concrete been used so extensively.

Now that the fight on the West front has developed into a sort of siege, both armies fighting from trenches, a method of making the trenches more sanitary and permanent has been sought by the army staffs. It now develops in this connection that a Chicago firm has received orders for several cement guns to be used in lining trenches with a coating of cement mortar "shot" onto a wire mesh by means of compressed air, thus facilitating drainage and sanitation.

It is thus seen that concrete is playing a great and heretofore unknown part in that "awful delirium" called war, and we likewise have no doubt that when peace is declared that concrete will be the prime material used in the building up of the devastated areas, since the idea of permanence will be foremost in the minds of the survivors.

The Effect of Mixing on Compressive Strength of Concrete

It has been more or less common knowledge among practical men for some time that mixing concrete for a longer period than is generally customary resulted in better and stronger concrete. Just to what extent the strength would be increased by increasing the length of time of mixing was, however, a rather debated and unsettled point on account of the lack of laboratory tests on this subject. In fact, many engineers, although they did not doubt that the strength of concrete was increased by longer mixing, rather discounted the resulting increase as being uneconomical in view of the much increased cost of mixing necessary.

A paper recently presented before the Indiana Engineering Society by H. H. Scofield on this subject discloses some very interesting facts. Briefly stated the tests (seven series of tests with six specimens in each series) show that the strength of concrete was increased from 27 to over 50 per cent by lengthening the mixing periods from 10 to 18 minutes over that of the usual ½ to 1 minute mixing periods. When the mixing period was of longer duration than 18 minutes, and for some mixes 10 minutes, the compressive strength showed a marked decrease, no doubt due to retempering of the concrete which took place by continuing the mixing after initial set of cement began.

Although these tests are by no means complete or conclusive (and should therefore lead to further tests along the same lines), engineers will say, and no doubt rightfully, that to make the mixing period from 8 to 10 times as long as is now common would be more costly than the additional cement required to make concrete of equal strength under ordinary mixing conditions. As an economic proposition, however, the longer or more thor-

ough mixing seems the better, and it therefore behooves the manufacturer to endeavor to put out a mixer which will make a considerably greater number of revolutions per minute than is now common, and in this way by slightly increasing the time of mixing make possible the beneficial results of more thorough mixing.

We venture to say that a great amount of concrete work which has proven unsatisfactory was placed in "record time," which in general means "insufficient mixing." Now, if we intend to make "concrete" stand for "permanence" a fertile field of investigation will be found in "the thoroughness of mixing," as is indicated by the tests cited.

The American Concrete Institute

The American Concrete Institute, as previously announced in these columns, held its 11th annual convention at Chicago Feb. 9-12, 1915. During this period 11 sessions were held, at which 35 papers and 6 committee reports dealing with roads, bridges, tests, design, art, architecture, plant management and cost were presented.

The convention was a success both in program and attendance. Some of the papers were exceptionally good, and papers of an "advertising" character, as have been presented in the past, were with one or two exceptions conspicuous by their absence. This is an interesting fact, for it means that the Institute is rapidly reaching its proper status, that of disseminating new ideas, results of tests and investigations in the concrete field among the men engaged in all branches of that great industry.

Recent gifts of over $15,000 to the Institute have placed it in excellent financial condition. In view of building up the society and giving it the proper publicity a permanent secretary, Mr. C. L. Fish, has been secured and a monthly journal will be published. Mr. L. C. Wason, who has done much toward the advancement of knowledge regarding concrete construction, was elected president.

Of the committee reports the ones on tests on concrete columns and on specifications for highway bridges and culverts were the most interesting. Abstracts of these reports will be given in these columns later. The report of the special committee on the fire in concrete buildings at the Thos. A. Edison plant in December, 1914, was very timely and resulted in giving much food for thought regarding concrete building design and construction.

Several papers on concrete road construction were presented. These developed the fact that during 1914 15,000,000 sq. yds. of concrete paving had been laid in the United States or more than in all previous years combined.

A subject which caused a good deal of discussion was the dusting of concrete floors. Mr. P. M. Bruner of St. Louis described his method of laying dustless floors, a description of which was given on page 16 of the January issue of *Railway Engineering*. Mr. Sanford E. Thompson in a paper on the "Design and Construction of the Massachusetts Institute of Technology Buildings," stated that in these buildings a dustless floor had been attained by the removal of all fine matter from the aggregate, thus precluding the possibility of any fine particles flushing to the surface. Several members strongly advocated the application of a coat of boiled linseed oil as a dust preventive after construction work was completed.

A paper by E. B. McCormick, of the U. S. Office of Public Roads, on "Test of a Reinforced Concrete Slab Bridge," described the first of a number of full size tests to determine the distribution of loads on a bridge floor slab. These tests should produce some valuable information for the designing engineer, and it is the editor's intention to give our readers the complete findings of these experiments when completed.

We are exceedingly glad to see the Institute in such a flourishing condition, ready to take its proper place among the many excellent technical bodies which have done so much toward the standardization of practice in their respective lines of endeavor. Another new departure which should result in the presentation of some valuable papers is the new prize, the Leonard C. Wason Medal, to be awarded annually by the Institute to the most meritorious paper published by the Institute during the year, this competition being limited to members.

Taken as a whole the Institute seems to have taken a new lease of life, and we sincerely hope that unlimited success will crown the efforts of those who have labored so long to make it a factor in the technical world. Every man interested in the promotion of concrete as a building material should become a member of the Institute and thereby derive all the benefit he can from the experience of others and at the same time give some of his own to others in payment therefor.

Honors for the Engineers of the Panama Canal

A merited recognition of the services rendered by the engineers of the Panama Canal was given by Congress in the closing hours of its session just finished. Col. Geo. W. Goethals was advanced in rank to major general and his army assistants, Col. H. F. Hodges and Lieut. Col. W. L. Sibert, were made brigadier generals of the line. Brigadier General Wm. C. Gorgas was promoted to major general, medical department. The navy representative on the Commission, Commander H. H. Rousseau, was made rear admiral. With the act providing for these promotions went the formal thanks of Congress to the officers named.

There was little of the spectacle in the manner of the bestowal. Honor of an unusual degree, was, however, shown by the action of the Senate in confirming the nominations immediately upon their presentation. The formal thanks of Congress carried with the promotions are no less unusual. No mark of distinction which great nations bestow for notable service has been so rarely awarded as the thanks of the Congress of the United States of America.

The Central Railroad of New Jersey contemplates construction of a bridge over Newark Bay.

The Engstrom-Hosford Co., of Northfield, Minn., has taken grading contract for 85 miles of work on the Van Horn & Valley, in Texas, from Runquist & King, of Duluth, Minn. Engstrom-Hosford Company has established an office at Van Horn, Texas. There is approximately 600,000 cubic yards of choice machine and side work to sublet.

Rahway River Arch Bridge, Penn. Railroad

A Six Track Concrete Arch Bridge Built in Connection With Grade Crossing Elimination at Rahway, N. J.

The largest structure built in connection with the elevation of the Pennsylvania R. R. roadway between Elizabeth, N. J., and Colonia is the six track concrete arch bridge, 120 ft. wide, composed of three 60-ft. arches, over the Rahway River at Rahway, N. J., which was built without interfering with traffic, which is unusually heavy at this point. In addition to this large structure the work involved a very heavy concrete retaining wall and underpass construction and fills, some of which are 25 ft. high. Fifteen grade crossings were eliminated by carrying tracks over same on through and deck plate girder spans with 12-in. reinforced concrete slab floors of trough construction between girders and waterproofed with felt and a bituminous compound covered with brick.

GENERAL DESIGN.

The arches of the Rahway River bridge are 3 ft. thick at the crown and are of plain concrete. Spandrel walls of a gravity section retain the earth fill over the arches. The backs of arches are waterproofed in the same manner as the floors of steel bridges over streets.

The showing faces of arch rings, spandrel walls, wing walls and coping were finished by rubbing the surface of the concrete with carborundum bricks. The outlines of the arch rings were delineated by V-shaped grooves and the voussoir or construction joints in rings were marked in the same manner. The plain surface of wing walls was relieved by horizontal coursing joints 2 ft. apart, and the divisions between arches are marked by paneled pilasters carried up from piers to top of coping as shown in Figure 1.

CONSTRUCTION.

The bridge was built in four longitudinal sections of 25 ft. width, the centering having been built for this width and moved laterally on rollers as each section was completed. The piers were built on 25-ft. sections in the same manner. Transversely the arches were poured in five voussoir sections as indicated by the voussoir joints in Figure 1.

The construction work was carried on by a cableway system 850 ft. long, with 65-ft. and 75-ft. towers, one located on bank of river and the other across the street at the west end of bridge, this street being bridged by a through plate girder span shown in Figure 2, which is really a continuation of the arch bridge, since a combination abutment serves as a support for both. From the concrete plant located on the north bank of the river the concrete was distributed to various points on the structure in buckets by means of the cableway.

COMMENT.

The lines of this structure, although very plain, are very graceful and effective. The illustration gives an excellent idea of how a massive concrete structure can be made to present a pleasing appearance by the use of scoring joints, heavy but plain copings, recessed paneled pilasters, and a rubbed surface finish.

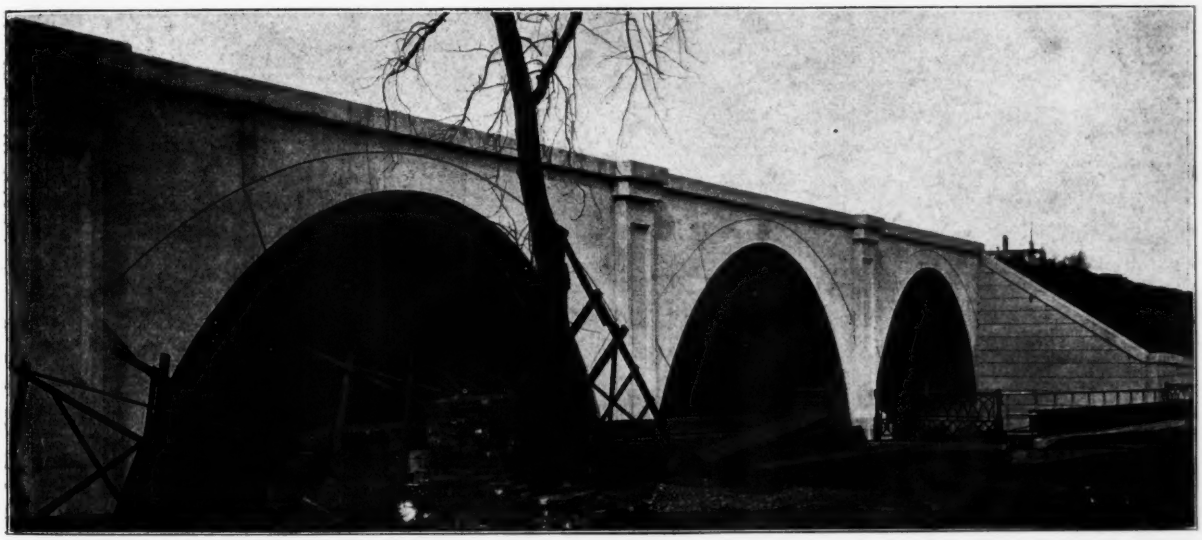


Fig. 1. Reinforced Concrete Arch Bridges near Rhodes, Ia., C., M. & St. P. R.

The bridge was built by the Keystone State Construction Co., of Philadelphia, under the direction of Mr. A. C. Shard, chief engineer of the Pennsylvania Railroad. The waterproofing was done by the Hydrex Felt & Engineering Co., of New York, to whom we are indebted for the photographs used herein.

As part of its 1914 improvement work the Duluth, Missabe & Northern constructed one 12x16 ft. concrete arch culvert to replace 2,600 of pile trestle, which was filled; two other wooden trestles were replaced by concrete slab trestles built on concrete piers; three wooden trestles were replaced by steel girder bridges with concrete slab decks and several small culverts were also built.

Unusual Structures of Concrete Built by Railroads

Description of a Concrete Arch Bridge, Framed Abutment, Concrete Dam, Crane Runway, Oil Tank Guard and a Reinforced Concrete Signal Tower

By A. M. Wolf, C. E.

The popularity of concrete as a material for the construction of railroad structures is emphasized by the great number of structural types which have been adopted as standard by various roads. It is also still further emphasized and the confidence which engineers place in it put beyond the question of a doubt by the many unusual and sometimes unique structures which have been erected.

It is the purpose of this article to illustrate and briefly describe some concrete structures which, although they may be unusual at present, will no doubt become standardized as have such structures as piers, ordinary gravity abutments, culverts, bridge floors and trestles. The growth of the concrete industry has been, and is at present, of such a rapid character that things which today seem unique are soon matter of fact and commonplace. It therefore seems well to occasionally leave the "beaten paths" of standard practice and treat of structures which will be fit subjects for further study and standardization.

CLEAR CREEK ARCH BRIDGE NEAR RHODES, IA., C., M. & ST. P. RY.

The reinforced concrete double track arch bridge over Clear Creek, near Rhodes, Iowa, C., M. & St. P. Ry., is unique in that it represents the combination of the open spandrel arch and the framed concrete abutment which provides an unusually large waterway for a relatively small arch span.

The entire structure is of reinforced concrete, the main arch having a span of 60 feet. A bridge of this type is especially adapted to locations in high fills where ordinary gravity abutments would be uneconomical on account of the large earth pressures which must be resisted. In an open abutment the earth slopes down unhindered to its natural angle of repose and throws very little or no load upon the structure.

This bridge was built in connection with the second track and grade revision work recently completed on the Chicago & Council Bluffs division in Iowa. The accompanying illustration (Fig. 1) shows a party of draftsmen of the engineering department while on a tour of inspection of the structures they had designed.

FRAMED ABUTMENT, C., M. & ST. P. RY.

The accompanying illustration (Fig. 2) of a large framed abutment for Bridge Z-814 on the C. & C. B. division of the C., M. & St. P. is interesting on account of the size of the structure and the economy of the type, which is apparent at a glance. An ordinary gravity abutment to retain a fill of such height would be a costly proceeding to say the least and if the same amount of additional waterway was provided as this abutment affords the cost of the steel work would be further increased. (For a more extensive treatment of framed abutments the reader is referred to Mr. A. W. Hoffmann's article, "A Novel Type of Abutment," on page 100 of the March, 1914, issue of *Railway Engineering.*—*Editor's Note.*)

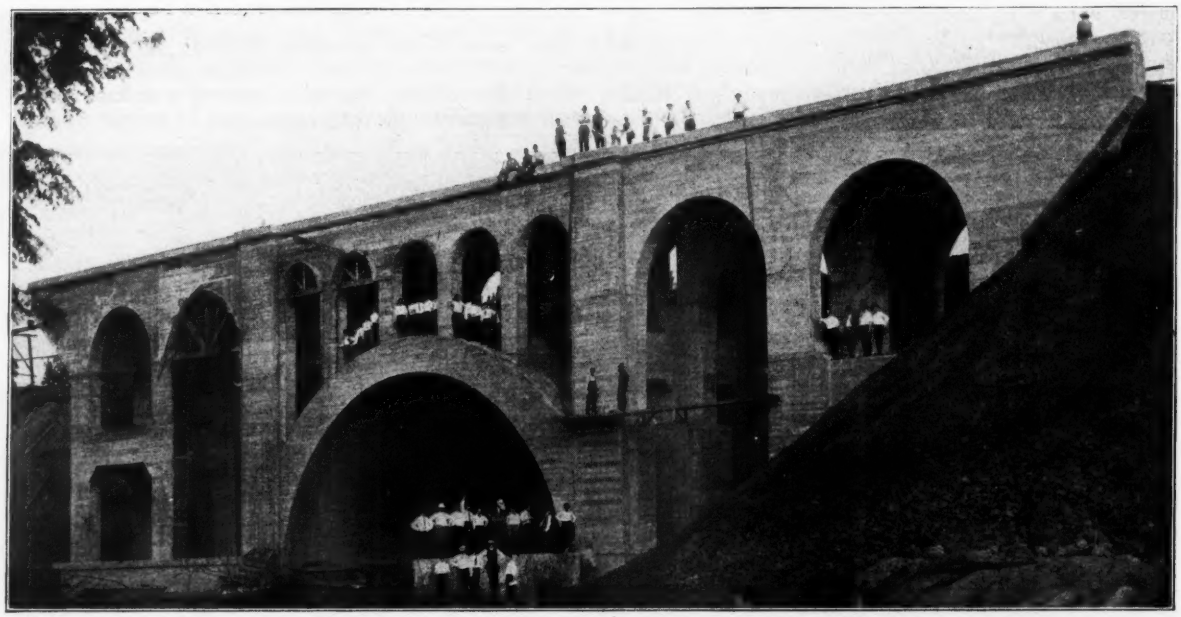


Fig. 1. Six-Track Concrete Arch Bridge, Rahway, N. J., Penna. R. R.

CONCRETE DAM, CREEKSIDE, PA., RESERVOIR, B. R. & P. RY.

The use of concrete dams for impounding reservoirs for water supply of railroads is somewhat out of the ordinary, it generally being considered too expensive. The dam illustrated in Figure 3 is constructed of plain concrete with overflow apron with sidewalls to restrict the water to the apron. The gate-house shown in center of illustration is also of concrete. The dam was built by the B. R. & P. Ry. at Creekside, Pa., for terminal water supply some distance away.

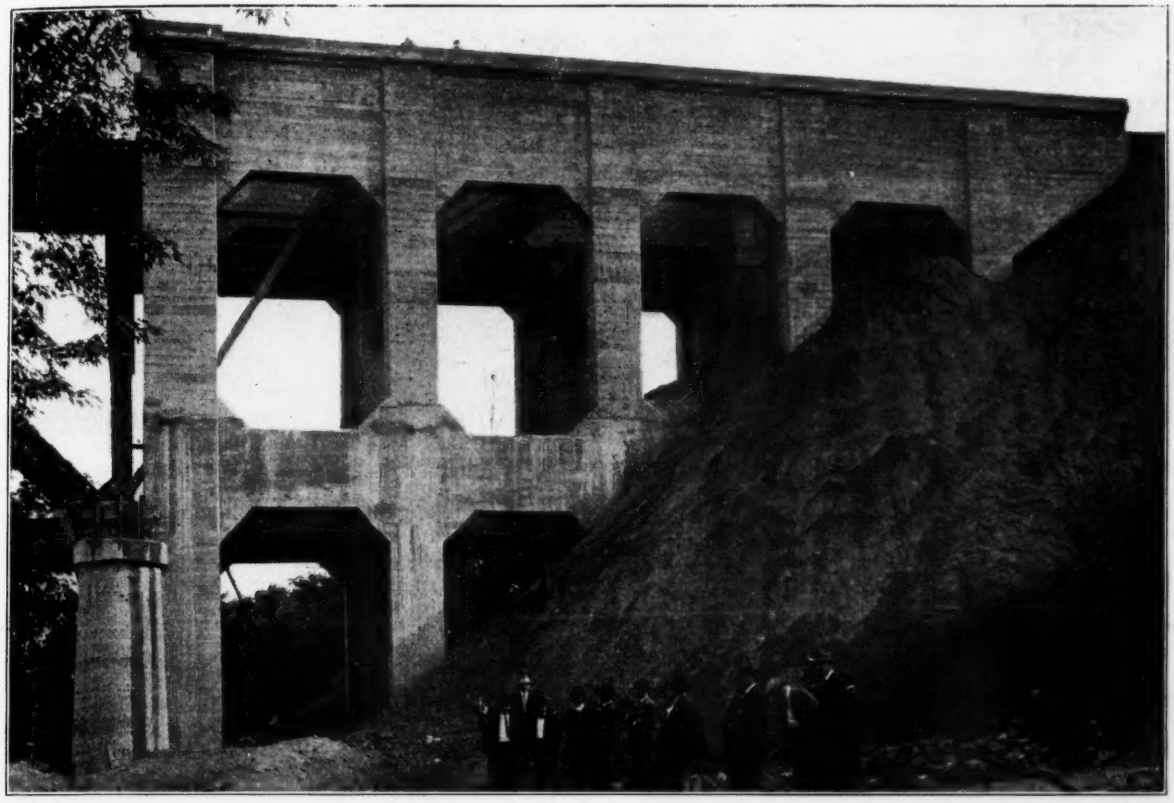


Fig. 2. Framed Abutment of Reinforced Concrete. C., M. & St. P. Ry.

CONCRETE CRANE RUNWAY FOR CINDER PIT, B. R. & P. RY.

In connection with the construction of a large concrete roundhouse at Du Bois the Buffalo, Rochester & Pittsburgh Ry. has constructed a reinforced concrete crane runway for traveling crane operating over a cinder pit.

The runway shown in Fig. 4 consists of two lines continuous concrete girders carried on buttressed columns, the traveling bridge crane spanning three tracks. The crane rails are anchored directly to the concrete girders.

Fires in cars at cinder pits are by no means uncommon occurrences and a fireproof crane runway is free from danger of damage by such fires. The maintenance cost of a structure of this type is practically nothing and it compares favorably in first cost with a structural steel runway.

GUARD WALL FOR OIL TANK.

Many of our western roads use oil for fuel for locomotives. This oil is ordinarily stored in large steel tanks and in order to protect an oil tank from fire and loss by leakage one road has built a reinforced guard wall 15 ft. high and 1 ft. thick around the same. (See Fig. 5.) The area enclosed within the wall is covered by a concrete floor slab, forming with the wall a secondary re-

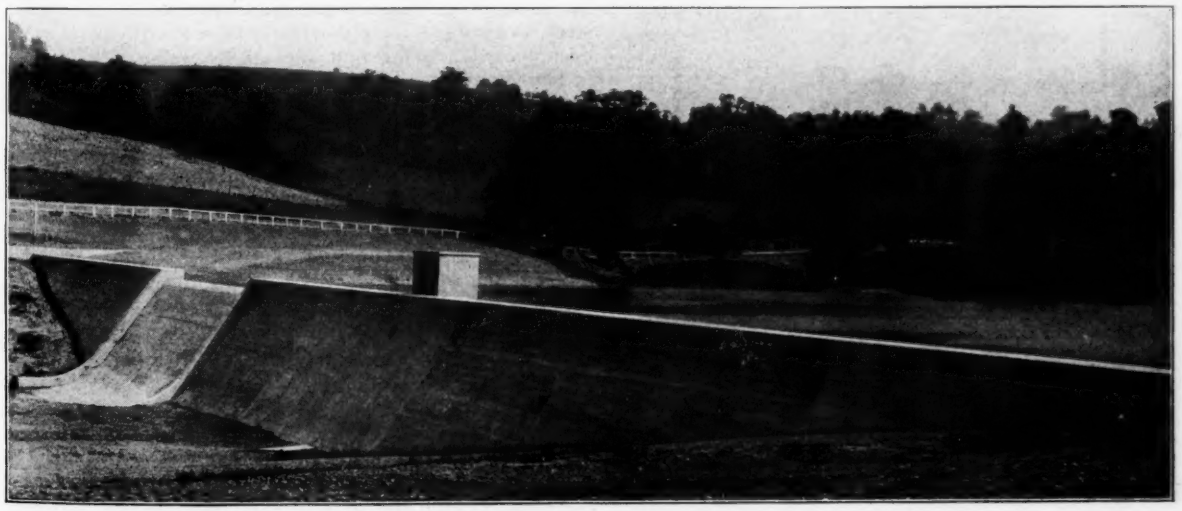


Fig. 3. Concrete Dam, Creekside, Pa., Reservoir, B. R. & P. Ry.

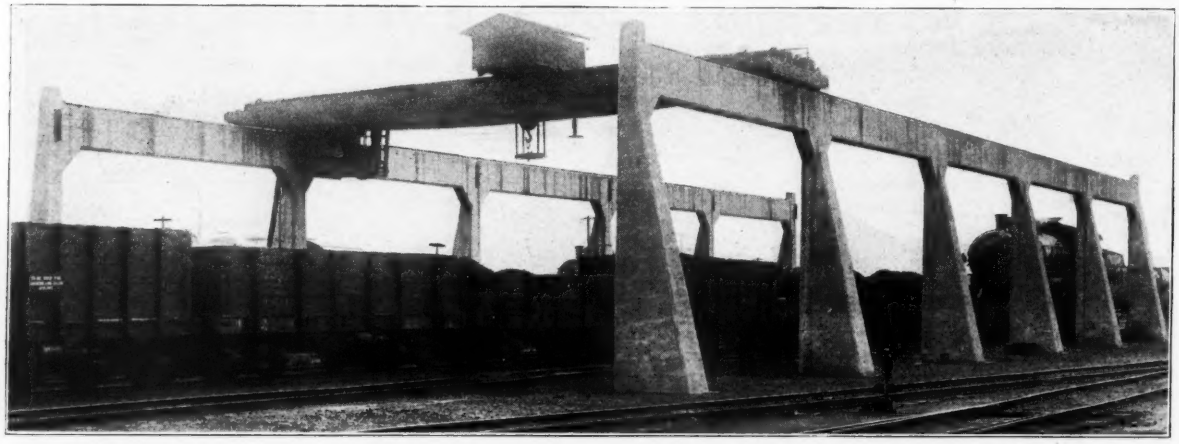


Fig. 4. Concrete Crane Runway, DuBois, Pa., B. R. & P. Ry.

tainer for the oil in case of damage to the steel tank. This structure then guards both the interests of the railroad and the people living nearby who might suffer loss in case the tank should break and the oil be set on fire.

Fig. 5. Concrete Guard Wall for Oil Tank.

REINFORCED CONCRETE SIGNAL TOWER, B., R. & P. RY.

Concrete signal towers are being used quite extensively by eastern roads and have become quite common in some localities. The tower illustrated here (Fig. 6) is of unusually fine architectural design, the general motif being particularly adapted to concrete.

Towers of this type have been adopted as standard by the B., R. & P. Ry. and several have been built at comparatively low cost. In one instance the entire cost of tower, including a 36-lever machine, was about $3,200.

Fig. 6. Concrete Signal Tower, B. R. & P. Ry.

The tower with exception of the roof is of reinforced concrete with wooden window frames, sash and doors, and a steel stair to observation room at the back of tower. The roof is of timber construction covered with Imperial Spanish tile. The use of large recessed panels with elliptical heads in sidewalls and corresponding shaped heads for large windows does much to enhance the appearance of this beautiful structure. The circular windows in the front and the heavy coping at sill line of upper story windows are architectural details which add little in cost but much in appearance.

One sees concrete signal towers in which absolutely no attention has been paid to architectural treatment and as a result the building is almost an eyesore to the station grounds instead of an ornamentation, as it should be. A building of the kind here illustrated costs only a small amount more than a merely utilitarian structure and from an architectural standpoint the extra expenditure is warranted by the results obtained.

Guarding Against Flood Damage

The San Pedro, Los Angeles & Salt Lake Railroad, profiting by the great damage wrought by floods in the southern part of California last year, has done much work with a view to prevent a repetition of damage and interference with traffic. Every bridge damaged last year has been replaced by a modern structure of concrete and steel, and many concrete culverts have been built wherever necessary to prevent damage to fills.

The Southern Pacific has built permanent bridges valued at $200,000 on its coast and valley routes south of San Francisco. The Santa Fe has expended about $382,000 for permanent bridges in the flood zone and an additional $100,000 has been used in widening cuts, revetment work and arranging for drainage and control of streams.

The East Broad Top R. R. & Coal Co. did a considerable amount of concrete work during the year 1914. A concrete block station was erected at Robertsdale, Penn.; a 20 ft. span concrete arch constructed over Shade Creek and a reinforced concrete arch bridge of four spans with a total length of 205 ft. built over Aughwick Creek.

The Chicago, St. Paul, Minneapolis & Omaha Ry. among other improvements carried out in 1914 built 11 reinforced concrete box culverts to replace pile bridges; one concrete arch and 36 reinforced concrete pipe culverts to replace pile bridges and timber culverts.

Concrete Frame Coaling Stations

Description of a Modern Concrete Coaling Station on the Chicago Great Western

The latter part of the year 1914 will not go down in railroad history as one of anything but general depression and few indeed are the roads which have done much in the line of new work or rehabilitation. Nevertheless, during the year the Chicago Great Western Railroad has erected several new coaling stations in addition to station buildings, grain elevators, water tanks and revetment work along the Missouri river.

Sometime ago this road adopted a policy of weighing all locomotive coal and to this end four new coaling stations were built, three of reinforced concrete and steel and one of timber construction. The first mentioned were built at Kenyon, Minn.; St. Joseph, Mo., and Carroll, Ia., and are of the Holmen type, with a capacity of 100 tons, so arranged that coal may be taken by locomotives either on the main track or the passing track under the structure (see Fig. 1).

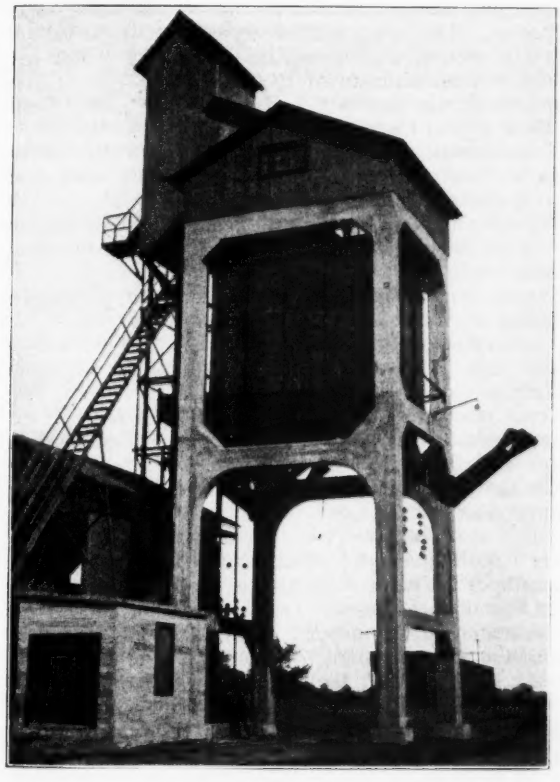


Fig. 1

The bins, which are built of structural steel, are suspended from scales at the top of a skeleton frame of reinforced concrete consisting of four columns resting on concrete footings, securely tied together by three sets of horizontal beams or struts, as shown in Fig. 1, which is an illustration of the Carroll, Ia., plant.

On the top of this concrete frame is a steel frame covered with corrugated iron, housing the scales and weighing mechanism. The coal is dumped from cars into a pit housed over by a steel frame shed at the rear of plant and hoisted to the bins by means of automatic hoists with a capacity of 75 tons of mine run coal per hour. These hoists are operated by 15 H. P. electric motors directly connected to Roberts & Schaefer reversible Holmen hoists, except at Kenyon, Minn., where an automatic Ogle reversible hoist is driven by a 15 H. P. Fairbanks Morse distillate oil engine. The driving machinery is located in the concrete house shown in the left-hand corner of Fig. 1. The entire plant is therefore well protected against any danger or disablement by fire, as is so often the case with wooden stations. One man operates each one of the plants very easily, since they are entirely automatic in their operation.

The new stations at Kenyon and St. Joseph replace wooden trestle stations of the obsolete type, where the cost of handling the coal has averaged about 9c per ton, and the Carroll station replaces two old wooden gravity type stations at Manning and Lohrville, Ia., where the labor cost of handling has been the same as mentioned above. According to Mr. W. C. Harvey, first assistant engineer, in *The Maize*, the labor cost of handling coal in the new stations has been reduced to about 2½c per ton, or a reduction of about 6½c. As these coaling stations handle in the neighborhood of 85,000 tons of coal during the year, the saving in labor alone will be about $5,500 per year. Besides this, there will be a great reduction in maintenance on account of the elimination of the old style trestle type of coaling station.

Strength of Slag Concrete

Some recent tests made by Prof. Harold Perrine at Columbia University for the National Slag Co. of New York have furnished some interesting results. The tests were made with trap rock and slag concrete in order to ascertain the comparative values of the two materials for aggregate.

The Hudson River trap rock was separated into ¾ in., ½ in., ¼ in. and dust, and was then artificially graded to the natural gradation of the slag as furnished by the company. The mixtures in both cases were 1:2:4 by volume, standard sand and cement being used in all cases.

The test cylinders 8x16 in. long were tested after 28 days; the average compressive strength of trap rock concrete being 1,976 lbs. per sq. in. as against 2,466 lbs. for slag concrete. Another interesting fact developed was the difference in weight between trap rock and slag concrete, the former weighing 154.5 lbs. per cu. ft. and the latter only 140.6 lbs.; the trap rock itself weighing 100 lbs. per cu. ft. and the slag 80 lbs.

Surface Imperfections

Imperfections in the exposed surfaces of concrete are usually due to one or more of ten well-known causes, as follows:

(1) Variations in the nature of the cement, sand or stone;
(2) Lack of uniformity in the amount of ingredients in each batch;
(3) Insufficient mixing in any or all batches of concrete;
(4) Lack of care in placing the concrete next to the molds;
(5) Lack of proper protection in placing concrete;
(6) Efflorescence and discoloration of the surface;
(7) Unsightly construction joints;
(8) Imperfectly made forms.
(9) Dirt on forms;
(10) Adhesion of forms to surface.

—*Concrete-Cement Age.*

The city of Philadelphia will build a concrete bridge and approaches to carry Broad Street over the joint four-track railroad, South Philadelphia Track Elevations.

Tests of Reinforced Concrete Columns

Abstract of Report of Committee on Reinforced Concrete, American Concrete Institute, Chicago Convention, February 10, 1915

These tests on large size reinforced concrete columns were made in the laboratory of the U. S. Bureau of Standards at Pittsburgh by observers from the Engineering Experiment Station of the University of Illinois.

Twenty-four columns were tested, having a variety of reinforcement both longitudinal and lateral as indicated in the accompanying table (Table 1). In the tests, measurements were made to find the deformation in various parts of the column, including the stretch of the spiral reinforcement. This set of tests is a part of a program laid out for the purpose of determining the influence of both spiral reinforcement and longitudinal reinforcement upon the structural properties of columns.

The schedule of tests consisted of five groups (selected to give data on the effect of different variables) as follows and as shown in Table I.:

Group 1. Vertical steel the variable, columns of the 1 and 4 sets (12 columns).

Group 2. Effect of increasing spiral. (Columns 5 and 5a.)

Group 3. Effect of protective shell. (Columns 6 and 6a.)

Group 4. Plain concrete. (Columns 7 and 7a.)

Group 5. Vertically reinforced columns with ¼-in. ties. (Columns of the 9 and 10 sets.)

TABLE I.

In columns with ½-in. spiral the pitch was 2 in.; in columns with ⅜-in. spiral the pitch was 2¼ in.

Column No.	Section.		Spiral Reinforcement.			Longitudinal Reinforcement.		Maximum Load, lb.	Unit Load, lb. per sq. in.	Average Strength of 8 x 16 in. Cylinders, lb. per sq. in.
	Diameter, in.	Area, sq. in.	Kind.	Per cent.	Diameter, in., c. to c.	Kind.	Per cent.			
1.....	20.84	341	½-in.	0.94	19.95	none	0.00	1,621,500	4760	2868
1a.....	20.82	340	do.	0.94	19.97	do.	0.00	1,555,000	4570	3083
1b.....	20.86	341	do.	0.94	19.93	do.	0.00	1,774,000	5210	2885
Average.....									4850	
2.....	20.98	345	½-in.	0.94	18.69	4 1-in. bars	0.91	1,626,000	4710	3393
2a.....	21.02	347	do.	0.93	19.68	do.	0.91	1,700,000	4900	2773
2b.....	20.94	344	do.	0.94	19.82	do.	0.91	1,766,000	5140	2860
Average.....									4920	
3.....	20.95	344	½-in.	0.94	19.37	8 1-in. bars	1.83	1,737,500	5050	3185
3a.....	20.96	344	do.	0.94	19.85	do.	1.83	1,647,000	4785	2575
3b.....	20.94	344	do.	0.94	19.91	4 1⅛-in bars	1.89	2,025,000	5885	2675
Average.....									5245	
4.....	20.66	335	½-in.	0.95	19.53	8 1¾-in. bars	5.75	2,069,000	6180	3095
4a.....	20.88	342	do.	0.94	19.76	do.	5.63	1,968,000	5750	2670
4b.....	20.85	341	do.	0.94	19.74	12 1⅛-in. bars	5.71	2,165,000	6350	2775
Average.....									6090	
5.....	20.87	342	½-in.	1.88	19.57	4 1-in. bars	0.92	2,060,000	6025	3035
5a.....	20.92	344	do.	1.88	19.73	do.	0.91	2,223,000	6495	2883
Average.....									6260	
6.....	24.09	455	½-in.	....	.....	4 1-in. bars	....	1,740,000	3825	3130
6a.....	24.23	462	do.	....	.....	do.	....	1,720,000	3725	2768
Average.....									3775	
7.....	20.87	342	none	0.00	.....	none	0.00	1,022,000	2990	2775
7a.....	20.96	344	do.	0.00	.....	do.	0.00	860,000	2500	2518
Average.....									2745	
8.....	20.04	315	....	....	.....	4 1-in. bars	1.00	1,040,000	3300	3308
8a.....	20.31	324	....	....	.....	do.	0.97	1,360,000	4200	3098
Average.....									3750	
9.....	20.13	318	....	....	.....	4 1⅛-in. bars	2.04	1,150,000	3620	3458
9a.....	20.21	321	....	....	.....	do.	2.02	1,206,000	3760	3055
Average.....									3690	
10.....	20.14	318	....	....	.....	8 1⅛-in. bars	4.08	1,451,000	4565	2835
10a.....	20.16	319	....	....	.....	do.	4.07	1,436,000	4500	2940
Average.....									4535	

The shaft of column for a length of 9 ft. 4 in. was generally about 21 in. in diameter. The two columns used to show the action of an outer protective coating were 24 in. in diameter. In the columns with spiral reinforcement the four spacers had an area equal to about 0.2 per cent of the column section. This metal was not used in computing the percentages of longitudinal reinforcement. Ties ¼ in. in diameter were placed 12 in. apart in the columns without spiral reinforcement. They held the longitudinal reinforcement in position during the fabrication of the column.

The concrete was of a 1:1½:3 mixture. With each column two cylinders 8 in. in diameter and 16 in. long were made for testing with columns, and additional cylinders of the same size were made to determine the increase in strength of concrete with age.

The cement used met the requirements of the American Society for Testing Materials. The sand was siliceous, clean, hard and gritty. The stone contained some pebbles of feldspar and mica schist, but it was well graded and clean. The spiral reinforcement was bright Bessemer wire with an average elastic limit of 63,000 lbs. per sq. in. and an ultimate of 85,000 to 88,000 lbs. The longitudinal reinforcement had an average elastic limit of about 35,000 lbs. and an ultimate of 57,000 lbs.

The columns were cast in well-made wooden forms and the reinforcement wired to same with cast iron bearing plates on both ends of longitudinal bars.

The columns were tested in the 10,000,000 lb. hydraulic testing machine at the Bureau of Standards Laboratory at Pittsburgh.

The accompanying table gives the general data of tests, including the make-up of all test specimens.

BEHAVIOR OF SPECIMENS UNDER TEST

The plain concrete columns gave no appreciable signs of failure until the maximum load was reached. The columns reinforced with vertical steel tied with ¼-in. hoops at 12 in. centers gave no marked sign of distress before the maximum load was reached. The equation which expresses the ultimate carrying capacity of these columns was found to be:

$$f = 3000\ (1 - p) + 40000\ p$$

where f is the average load over the whole column section and p is the ratio of the area of the longitudinal steel to the area of the column.

The action of the hooped columns during the early part of the tests was similar to that of the unhooped columns. At a load near the maximum which was carried by the unhooped columns having an equal amount of longitudinal reinforcement the observed stress in spiral was from 6,000 to 8,000 lbs. per sq. in., an amount which may be expected to correspond to the lateral expansion of the columns under slight restraint. The effect of this restraint at these loads was slight, perhaps equivalent to 150 lbs. per sq. in. vertical pressure in the columns with 1 per cent spiral.

Beyond the load which corresponds to the maximum load of an unhooped column the shortening increased rapidly with increase in load, the decrease in stiffness was very marked and the stress in spiral increased very rapidly. There were few signs of distress or approaching failure near the maximum load.

In discussing the properties of the hooped columns, the question at once arises as to what part of the cross-section of the column is affected by the restraint of the spiral and whether the whole section acts to resist the imposed load. The area of the cross section may be somewhat greater than the area which is effectively

restrained, but it cannot be far from the right one in view of the results of these tests. This should not, however, be taken to have a bearing upon what section should be used in designing columns.

It is apparent from the tests that the additional strength given by the longitudinal reinforcement is less in the case of columns with spiral reinforcement than in columns without it. For loads beyond the resistance given in unhooped columns, it would seem that the longitudinal bars may offer little or no additional resistance, and that the lateral swelling of these bars may increase the stress produced in the spiral without giving corresponding increase in strength to the column.

The formula:

$$f = 3000\ (1 - p) + 40000\,p + 160000\ (1 - 10\,p)\ q$$

brings out a probable limitation on longitudinal reinforcement in hooped columns. In this formula, f = average unit stress on entire section, p is the ratio of vertical steel to area of section and q is the ratio of the volume of spiral to volume of the column. The formula is of course limited by the range of the test variables, and it should be noted that the largest amount of spiral reinforcement in these tests was 4 per cent. The formula, however, brings out a probable limitation on longitudinal reinforcement in hooped columns.

The strength given by spiral reinforcement is larger than in other tests which have previously been reported. In judging of the results of the tests it should be borne in mind that these are short columns (less than 6 diameters between head), that the spiral reinforcement was well made and properly placed, that the columns were straight, and that the loads were applied in such a way as to produce little bending moment in the columns. It has been shown by tests that irregularity of pitch and inclination of the spiral produce the same effect as crookedness and may reduce the column strength.

The two columns with a thickness of about 2 in. of concrete outside the spiral were tested to determine the action of the fireproofing layer or protective shell under high loads. At the maximum load the longitudinal deformations were about the same as those of an unhooped column at its maximum. Up to the maximum load no cracks or other signs of distress were visible. At the maximum load the shell or layer outside the spiral cracked in various places in the upper portion of the column shaft, the load fell about 10 per cent and the fireproofing shell dropped off from this portion. With further application of load, which again reached nearly the original maximum, the exposed spiral stretched as is usual with a hooped column. The second maximum load corresponded to that to be expected with a hooped column having a diameter equal to that corresponding to the outside diameter of the spiral.

CONCLUSIONS

The results of these tests warrant the following conclusions:

1. They seem to confirm the current practice as to the effect of varying percentages of longitudinal reinforcement within the range of these tests as expressed in the following formula:

$$f = f_c\,(1 - p) + n\,f_c\,p$$

2. They indicate that columns with spiral reinforcement are stronger and tougher than columns with no spiral reinforcement.

3. From these tests it would appear that the spiral reinforcement is approximately four times as effective in giving ultimate strength to the column as the same volume of longitudinal reinforcement.

4. It appears that the effect of the longitudinal reinforcement decreases as the percentage of spiral reinforcement increases.

Decrease in Production of Cement

For the first time since the beginning of the cement industry in the early nineties the annual production of cement has decreased. For the year 1914 the quantity of cement manufactured was approximately 88,514,000 bbl., compared with 92,097,131 bbl. in 1913, or a decrease of about 3,583,000 bbl. or nearly 4 per cent. The estimated shipments of portland cement during 1914 were 86,715,000 bbl., compared with 88,689,377 bbl. in 1913, a decrease of about 1,975,000 bbl. or 2.2 per cent. On account of the surplus of production over shipments, stocks at the mills apparently increased more than 14 per cent, or from 11,220,328 bbl. in 1913 to 12,818,000 bbl. at the end of 1914.

Cheaper Cement Sacks

The Universal Portland Cement Co. has developed and will put on the market soon a cloth cement sack which costs only 5c or 20c per barrel, the aim being to furnish a container which will not have to be returned to the mill, but which at the same time will be much stronger than paper sacks, which have never proven satisfactory on account of the ease of injury to them.

The new type of cloth sack will be approximately six times as strong as a paper container and will readily stand one trip and still be of as much use to the consumer as the more costly sacks which so often were lost or rendered worthless by careless workmen. The difference in price between these new sacks and the usual cloth sack makes it possible to charge the small consumer outright with his package, as is the custom with other products, and still give him value received for his money and at the same time no one will have to stand a loss for unreturned sacks.

Large Reinforced Concrete Warehouse

The Midland Transfer & Warehouse Co., backed by the stock yards interests and the Chicago Junction Ry., is erecting at Western Ave. and 15th St., Chicago, a four-story and basement warehouse building for railway and storage purposes.

The building will be 260x405 ft. in plan, of reinforced concrete flat slab construction with panels 18 ft. 6 in. by 18 ft. 8 in. c. to c. of columns. The floor loads are 400 lb. per sq. ft. for first floor, 350 lb. for second except for space in the middle of building, where three railroad tracks will be carried on steel construction, encased in concrete. The third floor will have a capacity of 300 lb. per sq. ft. and the fourth 250 lb. There are to be six elevators of 4 ton capacity besides electric hoists and "lowerators."

The curtain walls will be of brick with cast concrete ornamentation. The general architectural motif is simple yet pleasing and very suitable for a structure of this type. The architect is S. Scott Joy and the general contractors are Stone & Webster. The entire plant will represent an investment of about $700,000 and will be ready for service August 1, 1915.

A contract was recently awarded Phelan-Shirley Co., Omaha, Neb., for double tracking the Union Pacific from Gateway Bridge to Unitah, Utah. Includes 150,000 cubic yards of earth excavation and 150,000 cubic yards of rock excavation.

Construction work is now being carried out by company forces on the Virginia-Blue Ridge from Tye River, Va., northwest, via Lowesville to Massies Mill, 22 miles. There will be a number of trestles and one 500-foot tunnel on the line.

Moving Retaining Wall Forms.

Moving an Entire Section of Concrete Retaining Wall Forms With a Locomotive Crane on the Chicago, Milwaukee & St. Paul

In connection with the construction of concrete gravity retaining walls for the 4¼ miles of track elevation on its Evanston Division the C., M. & St. P. Ry. has made very good use of a locomotive crane for handling large form units.

The retaining walls, which are about 17 ft. high, have vertical faces with recessed panels and sloping backs. The general details of walls are the same as those described in connection with the Bloomingdale Road track elevation of this road, on page 323 of the August, 1914, issue of *Railway Engineering*. These walls are built in sections 25 ft. long, the forms being built in unit sec-

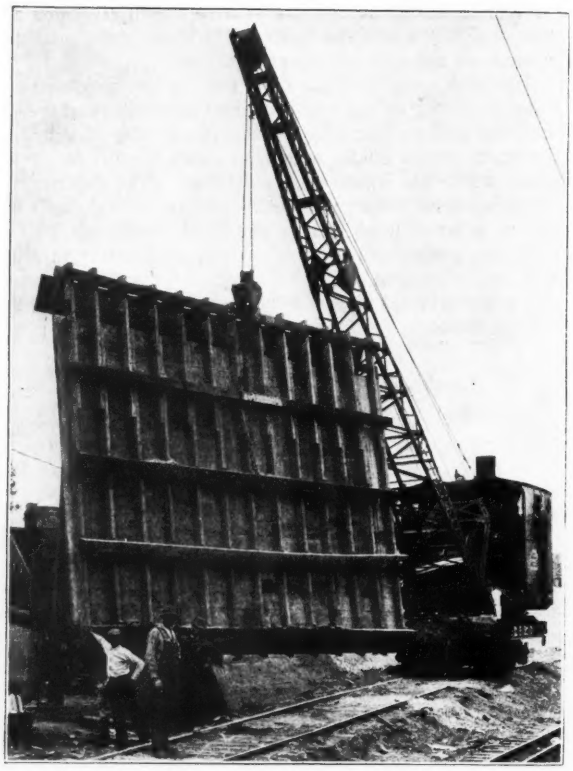


Fig. 1.

tions of this length. The forms are very heavily and rigidly constructed so as to readily stand the strain of being handled in the manner shown in the accompanying illustration.

In railroad construction work where tracks are laid to all parts of the work the locomotive crane can be used for many classes of work such as handling and moving excavation, forms, concrete and sections of construction track. On the piece of work in question the locomotive crane has done work of this character in an economical and efficient manner.

The Atchison, Topeka & Santa Fe will build a $15,000 passenger and freight station at Blackwell, Okla.

Reinforced Concrete Factory Buildings

A paper read by F. W. Dean at the convention of the American Society of Mechanical Engineers presents the advantages of reinforced concrete for the use of factory buildings, such as fire-resisting qualities, great window area, and good lighting, and also some of the disadvantages. It also points out that regular mill construction buildings have shown their fire-resisting qualities when properly designed. The best methods of finishing the floors are discussed and also the application of wood as a wearing floor above the concrete. The difficulties of fastening shafting hangers and machinery are brought out and the extra cost of drafting in consequence of this, as well as the great care required in making provision for everything to be installed. The different methods of constructing floors and the different forms of ceilings are taken up and also the relative costs of concrete and regular mill construction buildings.

Track Elevation at Spokane, Wash.

The Northern Pacific Ry. will shortly elevate about two miles of its tracks through Spokane, Wash., to a height of 12 to 16 ft. on solid fill between concrete retaining walls with about 20 bridges over streets. The change involves the keeping up of traffic of about 40 regular trains a day on from 12 to 15 tracks in some places, on a roadbed from 85 to 225 ft. wide. The north retaining wall will be built first, then a trestle erected along the north side and then fill for two main tracks, after diverted to these tracks and the remainder of the filling and the south wall built. The work is being carried out under the direction of W. L. Darling, chief engineer.

In connection with the grade separation work of the Northern Pacific Railway at Spokane, Wash., the engineering department has filed plans with the city engineer for nine reinforced concrete bridges to carry the railway tracks over Washington, Stevens, Howard, Wall, Post, Monroe, Madison, Jefferson and Adams streets.

The American Institute of Architects through its president, Mr. R. C. Sturgis, of Washington, D. C., has offered its services to the Lincoln Highway Commission, in connection with the designing of appropriate arches, bridges and tablets for use along the route.

Hauling Cement

The haulage of cement is distinctly in the heavy-duty class. The experience of the New England Cement Company, Fall River, Mass., is an interesting commentary on the greater economy of trucks for heavy-duty service. Four two-horse teams have been replaced by a three-ton motor truck. The truck averages 65 miles a day carrying a capacity load. The cost of the horse equipment 365 days in the year is $6,530. The combined wages of four men $1,800; total, $8,330. As against this, the fuel and oil cost of the motor truck was $650, repairs and overhaulings aggregated $370, interest on the investment at six per cent (investment of $3,800), depreciation at 20 per cent and also wages of driver. The total operating expenses of the motor truck for one year is $1,350.02. This leaves a balance in favor of the truck of $5,014.98. The insurance is not included in this figure, but estimated at $150, the net balance in favor of the truck would be $4,864.98.

The Western Pacific is said to have asked bids from Oregon lumbermen for 250,000 railway ties for delivery at Oakland, Idaho. The ties will be used for new line construction.

New Books

CONCRETE PILE STANDARDS. By Hunley Abbott. Paper, 9 x 12 in.; 59 pages, illustrated. Published by Berrian & Douglas, 22 Thames St., New York. Price, 50c.

A pamphlet devoted mainly to details for concrete pile caps, with a few pages dealing with the theory of their design. Detail drawings are given for footing containing from one to twenty-five piles. Just how the author has arrived at some of the methods of reinforcing the pile caps is not clear; for instance, on eight and ten-pile footings the bars are placed in belts in the form of an X between piles, while for a nine-pile footing they are placed in two ways at right angles to each other. In standards such as these such variations should not occur since they are exceptional, rather than standard.

Standard specifications, comparison of costs of concrete and wooden piles, methods of testing and an analysis of how a pile carries its load, make up the remainder of the book.

SUBWAYS AND TUNNELS OF NEW YORK. Methods and Costs. By G. H. Gilbert, L. I. Wightman and W. L. Saunders. Cloth, 6 x 9 in., 372 pages, profusely illustrated. Published by John Wiley & Sons, New York. Price, $5.00.

A most interesting volume setting forth the methods of construction and costs of the subways and tunnels in and about New York City. As the authors state, these enterprises represent engineering and contract achievement of such vast importance that they mark a new era in construction work. This tunnel and subway system includes: One complete subway system connecting three boroughs; eight subaqueous tunnels under the East river; six under the Hudson river; two under the Harlem river; the belt line tunnels and the New York subway of the McAdoo System, and the Bergen Hill and crosstown tunnels of the Pennsylvania railroad. These structures which have been built to solve the transportation problems of the great city of New York have demanded the expenditure of unlimited amounts of capital and have been accomplished only by the greatest engineering genius and skill.

In addition to detailed, illustrated descriptions of the construction of these tunnels, the book contains eight appendices on air compressors and kindred subjects; three on rock drills, one each on explosives, pumps and engineering data.

The book is well arranged with many excellent illustrations and detail drawings of tunneling machinery and apparatus. Every railroad engineer should possess a copy of this most interesting volume which so ably sets forth American methods of tunneling.

Current Prices—Concrete Materials

Portland Cement—The prices quoted on cement in the North Central States for March would indicate that the manufacturers are rather inclined to cut prices in order to get business, even though the prices have advanced somewhat. In the South and west of the Mississippi River the prices are unchanged and the demand is about the same. Prices given f. o. b. cars at points named, including cloth sacks, for which, in general, 40c per barrel (4 sacks) is refunded on return in good condition. Prices per barrel (including 4 cloth sacks) are as follows: Boston, $1.66; New York, $1.42; Chicago, $1.46 to $1.55; Pittsburgh, $1.45; New Orleans, $1.64 on dock; Memphis, $1.64; Cleveland, $1.54; Detroit, $1.54; Indianapolis, $1.58; Peoria, $1.54; Cincinnati, $1.58, Columbus, $1.62; Toledo, $1.58; St. Louis, $1.45; Milwaukee, $1.55 to $1.62; Minneapolis and St. Paul, $1.65 to $1.73; Kansas City, $1.43; Omaha, $1.43; Spokane, $1.75; Seattle, $2.30; Tacoma, $2.30; Portland, Ore., $2.30; Duluth, $1.77.

Crushed Stone—1½-inch stone, prices per cubic yard, f. o. b. cars in carload lots, unless otherwise specified. Boston, 80c per ton at the quarry; New York, 85c, in full cargo lots at the docks; Chicago, $1.05; Spokane, $1.00; Portland, Ore., $1.15; Seattle, $1.50.

Gravel—Prices given are per cubic yard f. o. b. cars in carload lots unless otherwise noted. Boston, 75c; New York, 90c in full cargo lots at docks; Chicago, $1.05; Spokane, $1.00; Portland, Ore., 85c; Seattle, 75c; Tacoma, 75c.

Sand—Prices are per cubic yard f. o. b. cars in carload lots unless otherwise indicated. New York, 50c, full cargo lots at docks; Chicago, $1.05; Spokane, 75c; Seattle, 75c; Portland, Ore., 85c; Tacoma, 75c.

Reinforcing Bars—Although the demand for bars has not increased materially, the steel manufacturers have determined to secure better prices and as a result March deliveries will be made on a basis of $1.15 per cwt., Pittsburgh, with prevailing extras for bars under ¾-inch or base; April deliveries to be made on an additional 5c advance. The following are quotations on base bars per 100 lbs. for mill shipments from other points, f, o, b, cars: New York, $1.31; Philadelphia, $1.30; Chicago, $1.33; Spokane, $2.20; Seattle, $1.85; Portland, Ore., $1.90; Tacoma, $1.85.

Shipments from stock are being made at the following prices per cwt. f. o. b. cars: Pittsburgh, $1.65; New York, $1.95; Cleveland, $1.80; St. Louis, $1.90; Chicago, $1.85; Spokane, $2.50; Tacoma, $2.20; Portland, Ore., $2.15; Seattle, $2.20.

Metal Clips for Supporting Bars—$4.50 to $6.50 per 1,000, depending on size.

For the majority of the prices given we are indebted to the Universal Portland Cement Co., Sandusky Portland Cement Co., Concrete Steel Co., American Sand & Gravel Co., Chicago, and F. T. Crowe & Co., Seattle, Portland, Spokane and Tacoma.

Reinforcing bars for mill shipments are in general sold on a Pittsburgh basis; this is, at the Pittsburgh quotations plus the freight to the point in question, and with the following list of freight rates on finished material and the Pittsburgh quotations given, the prices of bars at any of the points listed can be readily computed.

From Pittsburgh, carloads, per 100 pounds to:

Albany	16 cents	Columbus	12 cents
New York	16 cents	Cincinnati	15 cents
Philadlephia	15 cents	Louisville	18 cents
Baltimore	14½ cents	Chicago	18 cents
Boston	18 cents	Richmond	20 cents
Buffalo	11 cents	Denver	85 cents
Norfolk	20 cents	St. Louis	23 cents
Cleveland	10 cents	New Orleans	30 cents
Minneapolis	32 cents	Indianapolis	17 cents
Kansas City	42½ cents	Omaha	42½ cents
Birmingham	45 cents	Rochester	11½ cents

Freight Rates on Sand

The Yough Sand and Stone Company, Dunbar, Pa., with an operating plant at Friend Station, on the Connellsville and State Line Railway, has filed with the Public Service Commission a complaint against the Connellsville and State Line, Western Maryland, Pittsburgh and Lake Erie, Baltimore and Ohio, and the Pennsylvania railroads, alleging discrimination in the transportation rates in favor of competitors at Dunbar of from twenty to thirty cents a ton, depending upon the equipment in which the sand is loaded.

Atlas Cement Company

Mr. A. G. Croll has been appointed to act in capacity of general superintendent of the Atlas Portland Cement Company with headquarters at New York. Mr. W. H. Baker has been made assistant general superintendent, western district, with headquarters at Hannibal, Mo.

Contract has been let by the Southern Railway and work has been started on the installation of electric automatic block signals in connection with the double track now being built between Pelham and Denim, N. C., 36 miles. Forty-three signal towers will be erected. The signals will be operated by alternating current supplied by sub-stations at Danville and Greensboro and carried by a special transmission line. All stations and other railway buildings will be lighted by electricity. The signals will be of the same type—upper quadrant, three-position—now in use on the double track portions of the Washington-Atlanta line. In connection with signals now in service between Danville and Pelham and between Denim and Charlotte, the installation now undertaken will give a continuous stretch between Danville and Charlotte, 141.5 miles and a total of 336.46 miles so protected of the 649 miles between Washington and Atlanta.

Surveys have been made and the right of way is secured for a line to be built from Fort Myers, Fla., south along the west coast of Florida via Marco bay and Naples to Everglade, thence east across the southern part of Florida to Miami, on the east coast, about 150 miles. Capitalists of Baltimore, Md., are said to be back of the project.

The Three Forks, Helena & Madison Valley is projecting a line from Helena, Mont., through Rodensburg, Three Forks and Madison Valley to Yellowstone National Park, has graded 15 miles of railroad. Work is now suspended but it is expected to be resumed when weather is favorable.

LOCUST POINT PIER, BALTIMORE & OHIO

The Baltimore and Ohio Railroad is making a large addition to its facilities for handling export and import shipments at its Locust Point terminals by providing approximately 56,000 square feet of additional pier space. The specifications call for the enlargement of the present open Pier 5, which will be extended to a total length of 800 feet, by 69 feet in width, and the boat slip on the east side lengthened, thus accommodating two vessels on each side of the structure.

After its enlargement Pier 5 will be one of the largest piers in the Locust Point terminals and one of the most gigantic open piers on the Atlantic seaboard. The plans call for widening the pier 4½ ft. on the west side, razing the annex to the present brick warehouse on the east side of the pier and lengthening the boat slip 100 feet. Pier 5 will also be equipped with a raised platform for the full length of the pier, on the west side of the structure. The platform will be built on a level with the car floor, which will save extra handling of freight between car and vessel and result in economy in the cost of transferring shipments over the pier. Principally bulk freight is handled on the open piers at Locust Point, therefore the economical handling of heavy shipments will mean a substantial saving to the railroad company. The pier will contain four tracks so that cars can be run alongside the vessels for loading and unloading.

The additional pier space at Locust Point has become necessary on account of the steady increase in the volume of export and import business handled by the Baltimore and Ohio System through its Baltimore terminals. The enlargement of the facilities have been carefully studied with a view to facilitating the handling of the present business and providing for future requirements.

Pier 5, in addition to its open floor space, has connected with it a brick warehouse 270 feet by 78 feet in dimensions, the warehouse being used to store shipments.

The completion of the work on Pier 5 will make a total floor space of approximately 800,000 square feet in the freight piers in the Locust Point terminals, thus placing Locust Point well in the lead as the largest freight terminal on the Atlantic Coast.

Locust Point Pier No. 5, Baltimore & Ohio.

The Maintenance of Way Department

The Primary Cause of Rail Breakage

The Results of Lateral and Vertical Strains Rails Are Subjected to and the Primary Causes Rather Than Local or Specific Causes of failure

By H. C. Saunders, B. S., Formerly Engineer Edmont Radial Railway

A great many discussions have arisen over, and numerous commissions have inquired into, the causes of rail breakages under high speed traffic. So far as is known, however, almost all investigations have been conducted with a view to finding out the local causes for a specific break, rather than into the primary or fundamental causes of rail failure. The greatly increased wheel loads of recent years have been referred to at times, and occasionally reference is made to the increased carbon content of the rail, as tending to render breakages more numerous, but it would seem that a careful analysis of the complex strains to which a rail in service is subjected has yet to be made. Some slight attempt at this is the purport of this article.

A rail is usually considered as a continuous beam supported at regular intervals and subjected to a moving load, and on this theory the vertical stiffness has been increased as the load increased. This has been accomplished in two ways; by increasing the depth of the section, thereby adding increased weight to the rail, and by increasing the carbon content so as to obtain an increased modulus of elasticity. The first method has the objection that a greater proportion of the rail must be scrapped when the useful life has been obtained. The second method, while obtaining the above object, and also much decreasing the cold flowage on the surface of the rail head, makes the rail more brittle, and hence more liable to fracture from the impact of flat wheels.

Some designers have recognized the necessity of providing against the side thrust of surging trucks. The recent 105 lb. section of the New York Central is designed to meet excessive lateral strain through a thickening of the web directly above the base. But all designers appear to have started with the same premise of a continuous beam subjected only to the temporary strains induced by a moving load, and in doing so have neglected some very obvious conclusions which follow from a study of the track phenomena referred to in the next paragraph.

It would appear to the writer that there are certain strains of tension and compression acting longitudinally in a stretch of track which may become sufficiently important to merit serious consideration. In support of this theory, attention is called to the following not uncommon phenomena: creeping has been detected which embraced stretches of track two or three miles in length; track bolts have been sheared as the result of some violent horizontal force developed under apparently normal service; at times, on loosening joints, the rail ends have been observed to spring apart two or three inches. Then in regard to compressive forces, it would seem necessary only to call attention to the "sun-kinks" which supply so much work to the section-man. These phenomena are accounted for in a general way, as caused by creeping under traffic, or by temperature changes, but it would seem obvious that either of these two forces, to produce the results they do, must exert extraordinarily cumulative strains of tension or compression longitudinally to the rail. Another point to be considered is that if a state of compression exists at any point there must of necessity be a state of tension at some other point, since certain sections of the track are being forced towards or away from one another. After all slack or play between rails, angles and bolts is taken up longitudinal movement of the track continues until the tensile strains become serious. As found in practice, the maximum tension may reach a force sufficient to shear the joint bolts. The ultimate shearing strength of a one-inch track bolt ranges from 45,000 to 50,000 lbs. Where a track bolt is sheared in place the force is applied at two points, that is, on each side of the rail, so that to shear a single one-inch bolt in place in the track would require from 90,000 to 100,000 lbs. The shearing of the bolts in a four-bolt angle-bar would therefore indicate a force existing longitudinally to the rail of from 180,000 to 200,000 lbs., and in a six-bolt angle-bar this force would be from 270,000 to 300,000 lbs. The area of cross-section of an 80 lb. ASCE rail is 7.86 sq. in., so that the shearing of the bolts would indicate a stress in such a rail of 22,900 to 38,200 lbs. per sq. in. The safe working stress of the rail steel is only about 35,000 lbs, per sq. in., so that it is evident that the forces which would shear the track bolts even in the short angle-bar are dangerously near the elastic limit of the rail, while to use a six-bolt angle-bar and one-inch bolts on such a section would simply mean the removal of the only danger-signal at present existing which warns against the possibility of a broken rail.

It is a well-known fact that a member in a state of tension will break under a blow much more readily than if such tension did not exist. As a simple illustration of this statement, if the branch of a tree be bent, thus putting the upper fibres in a state of tension, it can be cut or broken much more readily than if struck while free. May not similar conditions exist in a case of rail breakage? In this case, not only the upper fibres, but the entire cross-section of the rail may be under extreme tension from the causes previously mentioned. Suppose, then, that in this condition it is subjected to a sudden bend, or blow from a flat wheel, or possibly a surging truck. The natural result follows: The rail breaks under the conflux of strains at this point, and conditions are favorable to the greatest damage. It is evident that the fatal combination of strains may not occur for years, or until the blow or bend becomes analogous to the proverbial "last straw added to the camel's load." Another factor, conspiring to increase the liability of rail breakage, is extreme cold, which is known to make steel more brittle.

As a proof of the correctness of this theory, attention may be called to the report on a case of broken rail as published in May, 1912. In this case the failure could hardly be attributed to any serious inherent flaw in the rail, as it had been in service for twelve years at the time of the accident. The condition of the track was good, the ground frozen, the rail (100 lb. section) solid on the ties, the ties sound, giving the best foundation obtainable in steam service. Yet the rail broke under the middle of the train, nine feet eight inches from the receiving end of the rail, and the next eleven feet was broken into fifty-five pieces. Under the microscope no sign of seams

or slag segregation could be found in the rail. Such shattering of a rail of such heavy section cannot be accounted for by an unusual hammer blow from a flat wheel or a surging truck traveling at high speed. It is only logical to assume that, after years of service, this rail broke only because of the existence of an accumulated, concentrated force of tension or compression to which the addition of some not unusual momentary force, as outlined in the preceding paragraph, produced a total force in excess of the strength of the section.

Given as a result of track creeping, that a state of violent tension (or compression) does develope in a stretch of track, then such effect must be cumulative, and appear as a maximum in some particular rail. It would seem that rail breakage would be greatly reduced by unequivocally avoiding the longitudinal strains that follow from track creeping. Instead of considering a stretch of rail as a continuous beam, as is the most common viewpoint, let us regard it as a series of comparatively short beam units arranged in tandem. This latter conception must be acknowledged as correct, when it is admitted that a certain longitudinal freedom of movement must be permitted to accommodate thermal changes.

The logical size of these proposed units would appear to be a single rail length, and the easiest method of localizing the strains, to anchor each rail length to the ties and ballast by means of some form of anti-creeper. Instead of permitting an accumulated creep, and driving it back from time to time at much trouble and expense, why not employ the ample force of a wheel load to accomplish, in units of one rail length, that which is now done (if done at all) by manual labor? In applying such force it is unnecessary to consider the causes of creeping or the violence of such forces. The ordinary forms of anti-creepers and the usual method of applying them do not fully accomplish the desired result. In short, an effective device should anticipate the creeping of each rail by utilizing the wheel load to depress a rail, not as at present, simply downward, but downward and backward.

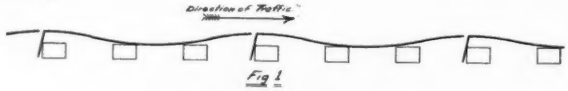


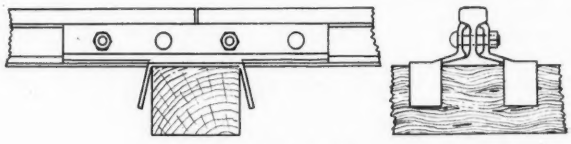
Fig 1

Wave Motion in Rail.

That the wave motion in a rail consists not only of a positive downward depression under each wheel but also of a negative or upward bend between points of load is now universally admitted, and it is obvious that the wheel immediately following such an upward bend must have a tendency to crowd this wave along ahead of it, ironing it out, as it were. In the writer's opinion, this action is an important factor in producing rail creeping. It can, however, be used to advantage in counteracting creeping. Let us consider a rail whose receiving end is bent downwards at a slight angle to the vertical. When the negative wave reaches this rail it is moved onward and upward to a position as shown in exaggerated form in Fig. 1. It may be objected that the rail could not lift above the tie as shown unless the spikes were loose. Loose spikes at joints are almost invariable, however, and even when the spikes have been freshly driven tight, the compressibility of the upper fibres of a wooden tie permits the action outlined, although in modified form.

Now, as soon as a wheel strikes the receiving end of this rail, it would depress, with the result that the inclined face pressing against the side of the tie would exert a force whose horizontal component would be opposite to the direction of the traffic, and whose intensity would vary directly as the wheel load.

Bending the rail as shown is obviously out of the question, and it is apparent that the inclined face or flange resting against the side of the tie must be supplied by some form of attachments to the rail, an anti-creeper, in other words. But the action of these anti-creepers should occur simultaneously with the entering of a wheel load upon the rail, as the backward thrust will then take place when the rail, being free from load, requires the minimum force for displacement. Furthermore, instead of being placed at intervals along the entire rail length, where the resistance against creeping is sustained by ties held only by the surrounding ballast, the location of anti-creepers should be such that when performing their function, they would engage the tie or ties which are restrained in place by the whole or partial wheel load. Therefore, the greatest restraining force will be furnished by the first tie under the receiving end of the rail in



Proposed Special Anti-Creeper.

question, and the next succeeding ties in diminishing efficiency. In order to obtain a backward movement of the rail, simultaneously with its depression, and thus compensate for all tendencies towards creeping as they occur, it is essential that the anti-creepers should be provided with a tie-impinging surface engaging the side of the tie at a slight angle to the vertical, instead of the flat form employed by all existing anti-creeping devices.

But even if the present forms of anti-creepers did supply this positive backward thrust, they would partially fail in our initial requirement, that of applying it at the receiving tip of the rail, and hence to a tie restrained in place at the instant of maximum superimposed load, rather than to one held in place only by ballast. To fulfil this condition it would appear essential that the anti-creeper be designed as an integral part of the rail joint, rather than as a separate attachment, some such device as shown in Fig. 2 being apparently necessitated.

We require, then, as an efficient safeguard against rail breakages, a rail joint structure possessing the following features: first, a combination of anti-creeper and joint that firmly fixes the receiving end of each rail; second, an automatic distribution of pressure between rails and angles such that the leaving rail end (regardless of direction of traffic) is comparatively free as to longitudinal movement; in other words, a pressure between the angle-bars and the leaving rail end just sufficient to ensure perfect alignment, without transmitting from rail to rail forces resulting from thermal changes; third, a positive backward thrust produced under load instead of an inert resistance; fourth, a construction which is effective regardless of the degree of care exercised by the trackman to obtain and maintain intimate contact with the tie; fifth, an automatically tightening grip between angles and rails, auxiliary to, or if possible replacing, the present joint bolts, and one which maintains a substantially uniform pressure between angles and rails, i. e., one which cannot become slack through wear or inattention throughout its entire useful life, nor too tight through excessive bolt pressure.

Meeting the first requirements of a combined joint and anti-creeper would appear to be but common practice, at least as to the matter of intent. As to the second requirement, if we had to deal only with traffic in one direction, it could be met possibly by using fewer bolts in the leading

end of the ordinary angle-bar than in the other, but to meet the requirement as stated above it is apparent that the clamping device must depend, not upon bolts, nor upon any other extraneous aid, but upon the traffic itself, that is, upon the superimposed wheel loads which are the result of the traffic. This would appear to demand some form of wedging action wherein the initial wedging force is supplied by the wheel load, and further, that abutting rail ends should be held in a practically separate grip. This last is advisable in order that the relative strength of such grips may be determined by the direction and thrust of the creeping force. A simple way to meet the third requirement would be to design the tie-impinging surface of the anti-creeper at an angle instead of vertically, as already outlined in this article. The fourth requirement would appear to be fulfilled best by an anti-creeper which would span the tie and reach down on both sides of it, thus making the tie itself serve to maintain the required contact. The fifth and final requirement can obviously be met by the same device as was suggested to meet the second, that is, by a wedging action deriving its force from the superimposed wheel load. Such a device would receive a tightening impulse with the passage of each wheel over the same, equivalent to maintaining a substantially constant tension of the joint bolts of the customary angle-bar.

Proper and Improper Track Maintenance

A Paper Prepared by H. M. Drowt, Section Foreman, C. M. & St. P. Ry.

Having been a foreman for 25 years or thereabouts and having worked on several divisions of the C., M. & St. P., I have had a chance to observe the different methods of handling track. I have come to the conclusion that we lack system in this particular branch. Not that the management differs so much, but section foremen vary widely in their methods of handling track, so much so and in many cases detrimental to the road, I feel that a more uniform system should be inaugurated. Believing that most of our track foremen read this magazine, I am taking this means to suggest a few simple rules that if followed out will, in my judgment, make considerable difference in one year in the cost of track maintenance.

The first subject I shall take up is proper tieing of track. I have taken note a great many times where ties are improperly spaced, which allows more bearing in one part of a panel of track than in another. This is a very bad practice and should be remedied. The reason bad spacing is bad for track is that where the least bearing is will be the first place to go down, while the place having the most bearing stays up. A very good way to get an equal bearing under all the panel is to space your ties just so a shovel blade will just go between them, which is 10 inches, this regardless of the width of the ties. Another bad feature in tieing is to place ties of unequal width in track haphazard, often with five or six small ends together on the same side of the track, this makes the side with the small ends considerably weaker than the opposite side, causing a sinking of the weak spot, necessitating frequent raising to keep it up to surface. This can be remedied by alternating the ties, having one wide end on one side and the next wide end on the opposite side.

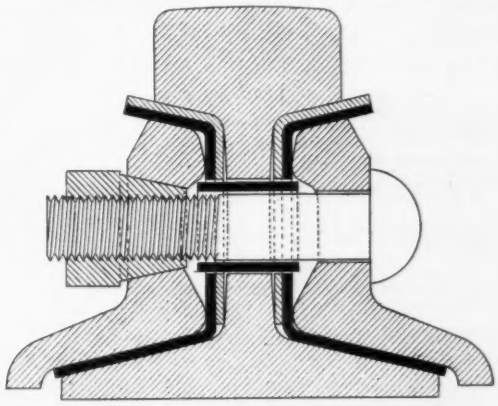
Joint ties should always have their widest end under the joint in broken joint track and their inside edges should not be over six inches apart. No joint tie should be less than ten inches wide if it can be avoided.

Tieing curves should not be done the same as on the main line. All the wide ends of ties on curves should be on the low or inside rail of curve, this on account of the low rail carrying the greater load, especially trains of slow speed. I believe before many years the management will give us 8 foot 6 inch ties for curves so we may allow the extra six inches for the low rail.—From the *Milwaukee Magazine*.

A NEW TRACK BOLT NUT AND INSULATED RAIL JOINT

The Ballou Safety Rail Joint Co., of Roanoke, Va., are manufacturing a new taper nut for use on rail joint bolts, and also an improved type of insulated joint. The principle of the nut is wedge locking, due to the conical surface and the large surface area presented for frictional bearing.

The illustration shows the Ballou Insulated Joint. The main features of this joint is to furnish more efficient, better service and longer life to the insulation. The application of the elongated nut will cause joint to remain tight while in service with very little attention. The cost is less than many other joints that are less efficient. The cost of maintenance is much less than any joint made.



Cross Section of Ballou Insulated Rail Joint, Showing Tapered Nut.

The Angle Bars are the same standard angle bars used on ordinary track joints. Half of the angle bars are offsetted from the center to one end, making room for the insulation and a steel plate between the insulation and the rail. The other half of the angle bars are standard and are drawn into tight relation with the rail, thus giving the insulated end much more support than if both ends were insulated. Tubular insulators cover the bolt where it passes through the web of the rail on the insulated end. And the same end post that is commonly used on all joints is used at the end of the rails, thus making a complete insulation.

The standard, or non-insulated portion, of the joint is placed on the receiving end of the rail, in double track work, in order to insure better resistance to wheel impacts.

The Milwaukee Western Electric, 715 Majestic building, Milwaukee, Wis., is reported to have made arrangements to begin work in spring on line to Beaver Dam.

E. W. Davis, Bozeman, Mont., is raising a bonus for the building of a railroad from Three Forks district up Madison valley to Yellowstone, Mont.

The Montana-Waumandee is making surveys for its proposed railway which will extend from a point on the Chicago, Burlington & Quincy through Waumandee to Montana, Wis.

The Nashville, Chattanooga & St. Louis is preparing to reconstruct its line between Huntsville and Gadsden, Ala., the work including several miles of new track along Tennessee river between Guntersville and Hobbs Island.

The Signal Department

Electric Interlocking Plant at Aulon, Tennessee

Description of Plant on the Nashville, Chattanooga & St. Louis. Handling Trains of Four Railways and Special Street Grade Crossing

On Jan. 20, 1915, an all-electric interlocking plant at Aulon, Tenn., was put into service. This plant is shared by the N. C. & St. L. Ry., the L. & N. R. R., the I. C. R. R. and the Union Ry. Signals and accessories were manufactured and installed by the General Railway Signal Co., of Rochester, N. Y., under the supervision of G. S. Plasterer, signal engineer of the N. C. & St. L. Ry.

SIGNAL TOWER AND WORK SHOP.

The interlocking tower, with a large and roomy work shop adjoining, was designed and constructed by the forces of the N. C. & St. L. The tower is a two-story brick building of artistic design, Fig. 1. The upper floor in addition to serving as a telegraph office contains the interlocking machine. The lower floor is used for the storage batteries, transformers, mercury arc rectifier and relay cabinet.

POWER.

The power is furnished by the Memphis Consolidated Gas & Electric Co. at 220 volts, with a frequency of 60. This current is transformed to 110 volts for the electric lights, both in the town and in the signals, and for one winding of each track relay. A double throw switch is provided so that lights may be operated by either alternating or direct current.

Direct current is obtained by transforming the alternating current by means of a mercury arc rectifier. A-4H Type Edison storage battery cells are used for supplying power to the interlocking machine and all switch and signal motors as well as for lighting purposes, in case of emergency.

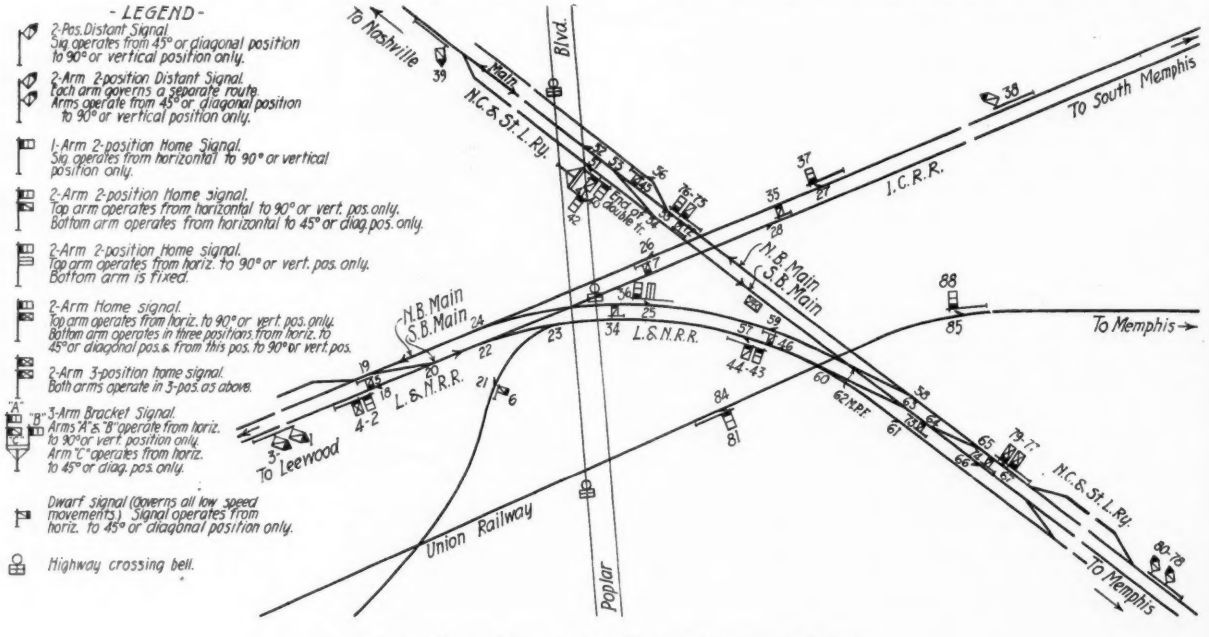
Two watt hour meters are used, one to register the energy consumed in lighting and the other the energy in charging the mercury arc rectifier and the A. C. track circuits.

HIGH SIGNALS.

The high signals are G. R. S. model 2 A, with top post mechanisms, which are mounted on iron posts. The home signals being semi-automatic signals.

All signals are operated by 4 pole D. C. 10 volt motors and are lighted by 2-C. P. 120 volt tungsten lamps.

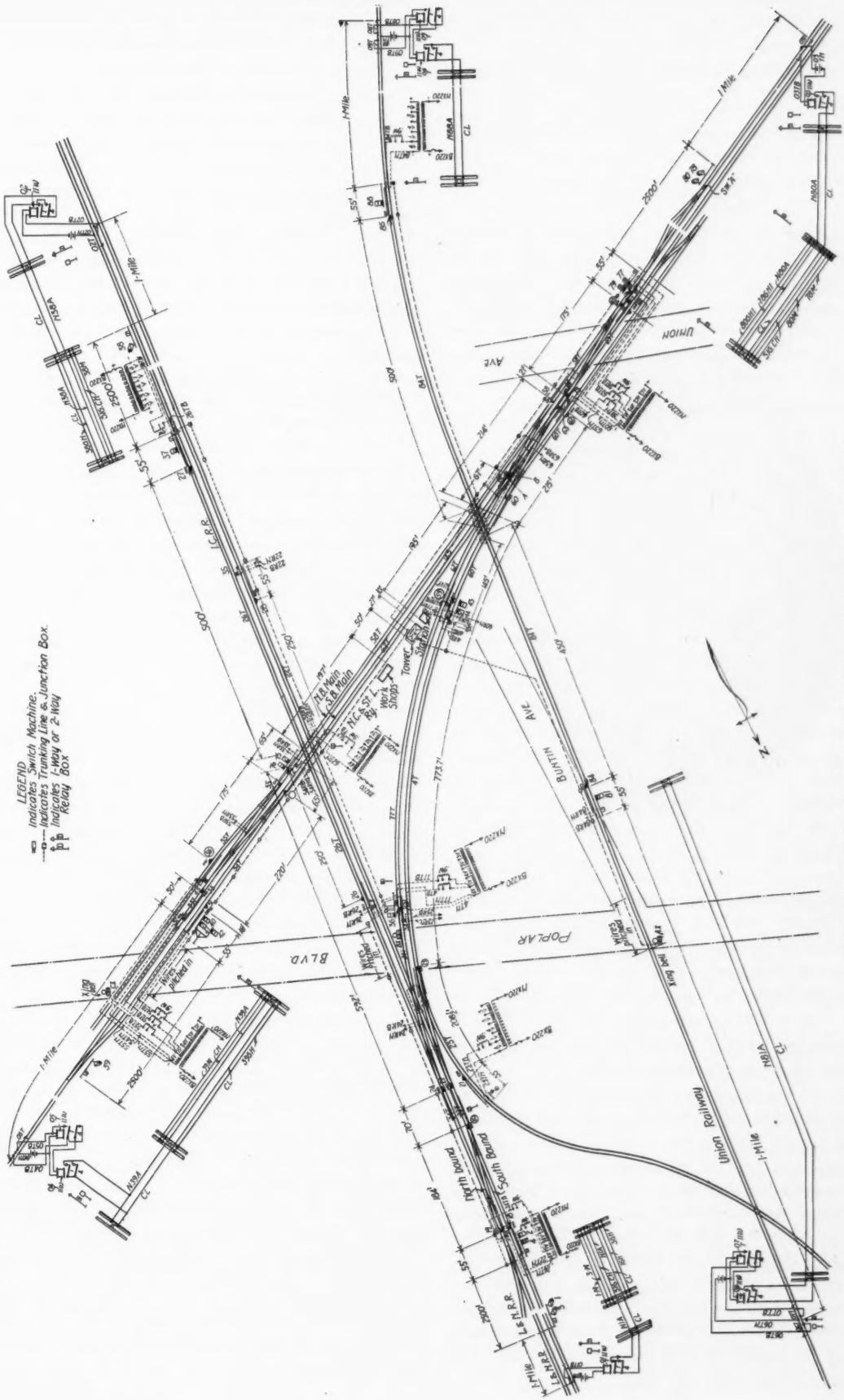
Blades, except for dwarf signals, are made of enameled steel, square end blades being used on all signals except distant signals, which have pointed blades. Blades are painted according to the standards of the respective roads on which they are used.


- LEGEND -
2-Pos. Distant Signal. Sig. operates from 45° or diagonal position to 90° or vertical position only.
2-Arm 2-position Distant Signal. Each arm governs a separate route. Arms operate from 45° or diagonal position to 90° or vertical position only.
1-Arm 2-position Home Signal. Sig. operates from horizontal to 90° or vertical position only.
2-Arm 2-position Home Signal. Top arm operates from horizontal to 90° or vert. pos. only. Bottom arm operates from horizontal to 45° or diag. pos. only.
2-Arm 2-position Home Signal. Top arm operates from horiz. to 90° or vert. pos. only. Bottom arm is fixed.
2-Arm Home Signal. Top arm operates from horiz. to 90° or vert. pos. only. Bottom arm operates in three positions from horiz. to 45° or diagonal pos. & from this pos. to 90° or vert. pos.
2-Arm 3-position home signal. Both arms operate in 3-pos. as above.
3-Arm Bracket Signal. Arms "A" & "B" operate from horiz. to 90° or vert. position only. Arm "C" operates from horiz. to 45° or diag. pos. only.
Dwarf signal (Governs all low speed movements). Signal operates from horiz. to 45° or diagonal position only.
Highway crossing bell.
To Nashville
Main
Blvd.
N.C. & St. L. Ry.
To South Memphis
I.C.R.R.
N.B. Main
S.B. Main
L. & N.R.R.
To Memphis
To Leewood
Union Railway
Poplar
N.C. & St. L. Ry.
To Memphis

Descriptive Chart of Signals, Aulon Interlocking, N., C. & St. L.

DISTANT SIGNALS.

All distant signals are two-position signals, operating from 45° to 90°. Each distant signal is operated by a lever in the tower and a circuit breaker on the signal immediately ahead. The locking in the machine is so arranged that no distant signal can be placed at "proceed" until all home signals in advance are placed at "proceed," giving a train the right to go through the entire plant at the maximum speed, which is limited to twenty miles an hour.



A Plan of Layout and Control Circuits, Aulon Interlocking, N., C. & St. L.

DWARF SIGNALS.

All dwarf signals are G. R. S. model 3 solenoid type. These signals operate in two positions only from 0° to 45° and are controlled by the interlocking machine.

NIGHT INDICATIONS.

Green being used for clear, a white light is an improper signal and must be regarded as a "stop signal." "Yellow" is used for caution and "Red" for stop.

AUDIBLE SIGNALS.

A low-voltage electric horn is placed on top of the signal tower. This horn has a very peculiar tone, being unlike the tone of those used in automobiles. This horn is used to call the attention of switch engines to through movements and to warn them so that they may get in the clear. It is also used for calling the maintainer when he is needed. A special code of signals has been adopted.

AUTOMATIC FLAGMAN AND CROSSING BELL.

On account of the density of the highway traffic on Poplar Boulevard, which crosses all four railroads, considering the number of automobiles that travel this boulevard at night, and realizing the effect of the noise made by them, in not only deadening the noise made by an approaching train, but also the deadening of the sound made by the ordinary crossing alarm bell, and taking these things into consideration, it was deemed necessary to install something more effective than the usual highway crossing bell. After careful consideration the Brach Automatic Flagman was decided upon. The Brach Automatic Flagman is a signal in which eight stationary lamps are located between red lenses so that the light from these lamps is shown on both approaches of the crossing, giving the effect of a swinging red lantern, which implies that there is danger ahead. Above the lights in suitably large lettering is the sign "Railroad Crossing." In addition to the above there is a locomotive type of bell of far-carrying power.

DERAILS.

All crossings, sidings and conflicting routes are protected by derails. Morden Lifting derails being used on the main lines for high speed movements and Hayes Lifting derails being used for main line low speed movements and siding protection.

DETECTOR BARS.

In addition to detector circuits, 53 detector bars are also used as an extra precaution.

INTERLOCKING MACHINE.

The interlocking machine is of the unit lever type, containing 88 levers, having 53 working levers with 27 spare spaces operating 61 functions. Plenty of spare levers are provided so that the machine is sufficiently large to accommodate the plant in case extra functions are to be added. One lever is employed for each signal and for each switch or derail, when the latter is operated entirely independent of any other switch or derail, but when two switches or two derails or a switch and a derail always work together, the two levers are tied together and operated by one handle, the indications and controls being separate and independent.

The movement of the signal lever is identical with that of the switch lever, except that no electrical indication is required during the reverse movement.

ANNUNCIATOR CIRCUITS.

Tower annunciators with bells give the leverman an audible signal of any approaching train. These indicators are normally de-energized, the circuits being completed through the closing of contacts in relays which are also normally de-energized, but are closed by a train approaching. It will be seen from the location plan, Fig. No. 2, that on single track an additional relay is added at the track circuit which accomplishes a traffic direction feature, so that the bell only rings when a train is approaching. These indications are given when the train is approaching the last signal and exactly one mile from it.

TRACK CIRCUITS.

Alternating current is used for track circuits throughout the entire installation.

TRANSFORMERS.

Track transformers consist of a primary coil which is fed from the 200 volt mains, and a secondary coil, which feeds current to the track circuit. The secondary coil has several taps which are arranged so that the voltage may be varied according to the length of the track circuit. Variable resistances are used on one lead of each track connection to the secondary coil, so that the one secondary winding feeds all track circuits at one location. Each primary coil is protected by a fuse.

TRACK RELAYS.

All track relays are G. R. S. model 2A-A. C. type. This relay will operate a long track circuit on very little energy.

These relays contain two energizing windings, one of which is energized from the 110 volt mains, this winding is energized at all times, the other winding is energized through the track circuit from the energy supplied by the secondary winding of the track transformer at the other end of the track circuit. Whenever a train comes into the track circuit, which the relay controls, the current being taken up by the train, the winding connected with the track circuits becomes de-energized and the relay contacts open.

The model 2A relay has a capacity of 12 independent circuits, any combination of front and back contacts can be used within these limits. These relays operate with exceedingly high drop away. Some of the advantages that the A. C. relays have over the D. C. relays are that they are absolutely immune to the effects of foreign current and then so much more energy can be applied than is practical to apply to the D. C. relay that it makes its action much more positive and reliable. A. C. relays are especially desirable at Aulon, as there are several trolley lines crossing the tracks just outside of the interlocking limits, and foreign current is very much in evidence, which would decrease the reliability of the D. C. relay.

INSULATED JOINTS.

"Keystone" insulated rail joints of the non-symmetrical type are used.

BONDING.

Each rail is bonded with two copper bond wires, only tinned channel pins being used.

ROUTE AND STICK LOCKING.

Besides the regular mechanical detector-bars, all switches, derails and the movable point frog are protected against being moved under a train by detector circuits. This is accomplished by breaking the indication control of these levers through the track relay.

All high signals are provided with stick locking. This is a form of approach locking which becomes effective on the reversal of the home signal lever and does not depend on the approach of the train. When a signal is once cleared, the route governed by that particular signal cannot be changed until a predetermined period of time has elapsed, or else until after the signal has been accepted and the train has passed out of the section immediately ahead of the home signal. This makes it absolutely impossible for the route which has once been set up, as indicated by the signal at proceed, to be changed, in case the signal is thrown to danger in the face of a moving train, until sufficient time has elapsed for the engineman to bring the train to a full stop. If this precaution were not taken it would be possible to give a proceed signal and then to take the signal away and open a derail in the face of a train running at high speed, before sufficient time had elapsed to bring the train to a full stop.

Emergency releases are provided, whereby the contacts on the A. C. track relays can be shunted and the leverman continue to operate the plant, even though the alternating current is cut off.

LINE WIRES AND TAGGING SYSTEM.

The crossarms, pins and insulators necessary for the signal wires were put in place on the poles by the Western Union Co.'s forces. The line wires were strung by the General Railway Signal Co.'s forces according to the arrangement shown on the general location plan. The stringing of signal wires according to a location plan is of great advantage to the maintainer in that whenever a particular section fails, which he attributes to line trouble, he can very readily locate the trouble by means of the plan.

TAGGING SYSTEM.

In a plant of this size where such a considerable number of units are controlled, it is very essential that a comprehensive system of identification be provided for the various wires, in order that the maintainer may locate any part of a circuit in the least possible time, or that in his absence one less familiar with the plant may have a diagram by which he may readily locate any part of a circuit. To this end wiring plans were made and bound into a booklet of convenient size, showing the arrangement of all wires, and each wire is numbered in accordance with a recognized standard used by various railroads and signal companies. Terminal boards are provided in the relay cabinets and at each signal location. On each terminal is a fiber tag on which is stenciled the number of that particular circuit, corresponding to the number on the wiring plan.

INSTRUCTIONS TO TRAINMEN.

Several weeks before the plant was put into service, a complete descriptive signal chart was compiled by the signal engineer of the N. C. & St. L. and posted on the bulletin boards of the several roads so that all trainmen would have ample time and opportunity to familiarize themselves with the rules, indications and signal movements.

PERSONALS

G. P. Smith has been appointed Consulting Engineer of the Big Four, with headquarters at Cincinnati.

C. A. Paquette, chief engineer maintenance of way of the Big Four Railway Company, has been promoted to chief engineer, effective March 1st, in charge of both maintenance and construction.

C. A. Paquette.

Mr. Paquette's railway experience covers a period of twenty-four years, most of which has been with the Big Four. His ability was early recognized and he has been rewarded in well deserved promotions. He has held many positions of importance and for many years has been a familiar figure in railway circles.

Born April 2, 1872, at Detroit, Mich. Graduated from Notre Dame University in 1891. Entered railway service July, 1891, taking a position as rodman with the Lake Shore & Michigan Southern Railway; May, 1892, to April, 1893, transitman, Peoria & Eastern Railway; May, 1893, to July, 1894, assistant engineer; July, 1894, to October, 1899, engineer maintenance of way; October, 1899, to September, 1902, superintendent; September, 1902, to June, 1906, superintendent Chicago and White Water Division, Big Four Railway, with headquarters at Indianapolis; June, 1906, to December, 1913, assistant chief engineer, with headquarters at Cincinnati; December, 1913, to March, 1915, chief engineer maintenance of way.

B. H. Bryant, civil engineer, has returned from Guatemala, Salvador and Honduras, where he has been locating railroad lines as chief locating engineer of the International Railways of America, and is taking a much needed vacation in Washington, D. C. Mr. Bryant, who has acted in the capacity of division engineer, chief engineer, construction engineer and general superintendent of steam railways in the United States, Canada, Mexico, Brazil and South American countries for many years, is well known

among railway men. He expects to return to active work in the spring.

Andrew Alfred Woods, whose appointment as superintendent of the New Orleans & Northeastern, with headquarters at New Orleans, La., has been announced, was born on March 2, 1876, at New Orleans. He graduated from the School of Engineering at Tulane University and subsequently took a post-graduate course in engineering at the same university. His first railway work was as a rodman on the New Orleans & Western, now a part of the New Orleans Terminal Company. From June, 1896, to July, of the following year, he was a draftsman in the maintenance of way department on the New Orleans & Northeastern, and then for six months was draftsman in the mechanical department of the same road. He then served as draftsman and inspector on bridge pier construction on the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific, until September, 1899, when he was appointed assistant engineer in the maintenance of way department of the New Orleans & Northeastern. From November, 1901, to July, 1913, he was resident engineer in charge of maintenance of way on the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific. He was appointed resident engineer in charge of maintenance of way on the New Orleans & Northeastern in July, 1913, which position he held at the time of his recent appointment as superintendent of the same road as above noted.

H. M. Church, division engineer of the Baltimore & Ohio at Philadelphia, Pa., has been appointed division engineer of the Baltimore division, with headquarters at Baltimore, Md., succeeding W. I. Trench, deceased.

Frank G. Drum, of San Francisco, Cal., and Warren Olney, Jr., general counsel of the Western Pacific Railway, have been appointed receivers of that road.

J. S. Joyce has been elected president of the Tremont & Gulf Railway, succeeding R. B. Fowler, who was elected vice president and appointed general manager.

W. P. Kenny, vice president in charge of traffic of the Great Northern Railway, has been elected president of the Great Northern Express Company, succeeding D. S. Elliott, resigned.

W. M. Ansley has been appointed acting superintendent of the Second district of the Canadian Pacific Railway, Alberta division, in place of F. Walker, superintendent at Lethbridge, Alta., who has been granted a leave of absence.

H. Eicke, whose appointment as superintendent of transportation of the Wabash Railroad has been announced, was born, raised and educated in Germany, and came to this country when 18 years old. For a few years he was employed as a clerk in various mercantile houses in Chicago and for two years he was with the Pullman Palace Car Company. In June, 1885, Mr. Eicke entered the service of the Wabash Railroad as a clerk in the local freight office, where he held successively the positions of assistant cashier, cashier, accountant, and chief clerk. In November, 1894, he was appointed local freight agent at Chicago and continued in that capacity until February 15, when, as heretofore noted, he was appointed superintendent of transportation of the Wabash, with headquarters

William Pelham, master carpenter of the Erie Railroad, at Marion, Ohio, has been appointed to the newly created position of inspector of bridges and buildings, with headquarters at Cleveland, Ohio. J. Orcutt has been appointed master carpenter at Marion, succeeding Mr. Pelham.

F. B. Wiegand, signal engineer of the Lake Shore & Michigan Southern, has had his jurisdiction extended over the Illinois division of the New York Central, formerly the Chicago, Indiana & Southern, effective since the consolidation of the Lake Shore & Michigan Southern with the New York Central & Hudson River. His headquarters will remain at Cleveland, O.

W. L. Connors, who has recently been appointed general signal foreman of the Buffalo, Rochester & Pittsburgh, with headquarters at East Salamanca, N. Y., was born at Franklinville, N. Y., August 7, 1883. He was raised on a farm and received his earlier education at a district school, after which he entered the Ellicottville high school. His first employment with the Buffalo, Rochester & Pittsburgh was that of groundsman in a line gang during the summer months, but he was later made lineman. In 1907, he accepted service with the National Transit Company of Bradford, Pa., as extra lineman on maintenance and construction. He remained there only a few months and then entered the Hall Trade School at Buffalo, taking an electrical course, after which he returned to the National Transit Company. In November, 1909, he re-entered the employment of the B., R. & P. as assistant telegraph maintainer on the Middle division, with headquarters at Dubois, Pa. Since that time he has held the positions of general foreman in charge of an installation of telephone train despatching, foreman on signal construction, assistant maintainer, maintainer, and finally was appointed general signal foreman in charge of signals, telephone and telegraph, as noted above.

SUPPLY TRADE NEWS

Wellington B. Lee, whose appointment to the position of vice-president of the Track Specialties Company, Inc., New York, has been announced, was formerly with the Ramapo Iron Works, Hillburn, N. Y., and was with that company 24 years. Mr. Lee was born January 29, 1867, at Wilmington, Del. He entered the service of the Ramapo Iron Works in 1888 and served as chief draftsman of that company for 12 years, after which he was an engineering salesman for 12 years more. He is a member of the American Society of Civil Engineers, and also of the Engineers' Club of New York.

The National Carbon Company will exhibit the new Columbia signal cell at the National Railway Appliances Association exhibition—March 15th to 19th, inclusive—at the Coliseum, Chicago (Space 151), located at extreme north end of building. This cell conforms to R. S. A. specifications.

The Indianapolis Switch & Frog Company will exhibit and demonstrate one of their latest developments, the Indianapolis high duty blue bolt, made of Indian-electro steel with a tensile strength of 135,000 lbs. per sq. in. This bolt is especially designed for bolting frogs and crossings, either for repairs or in new work. The company will occupy spaces Nos. 49 and 50.

At the annual meeting of the stockholders of the Union Switch and Signal Company, held March 9, in the Westinghouse building, Pittsburgh, Pa., the following directors were elected: J. D. Callery, J. J. Donnell, William McConway, J. R. McCune, J. R. McGinley, M. S. Rosenwald, T. W. Siemon, W. D. Uptegraff and H. H. Westinghouse.

The newly elected directors later went into executive session and chose the following officers for the ensuing year: President, Mr. Uptegraff; vice president and treasurer, Mr. Siemon; secretary and assistant treasurer, Thomas S. Grubbs; assistant secretary, G. F. White. The new executive committee that was appointed is composed of Messrs. Callery, Donnell, McCune, Siemon and Uptegraff.